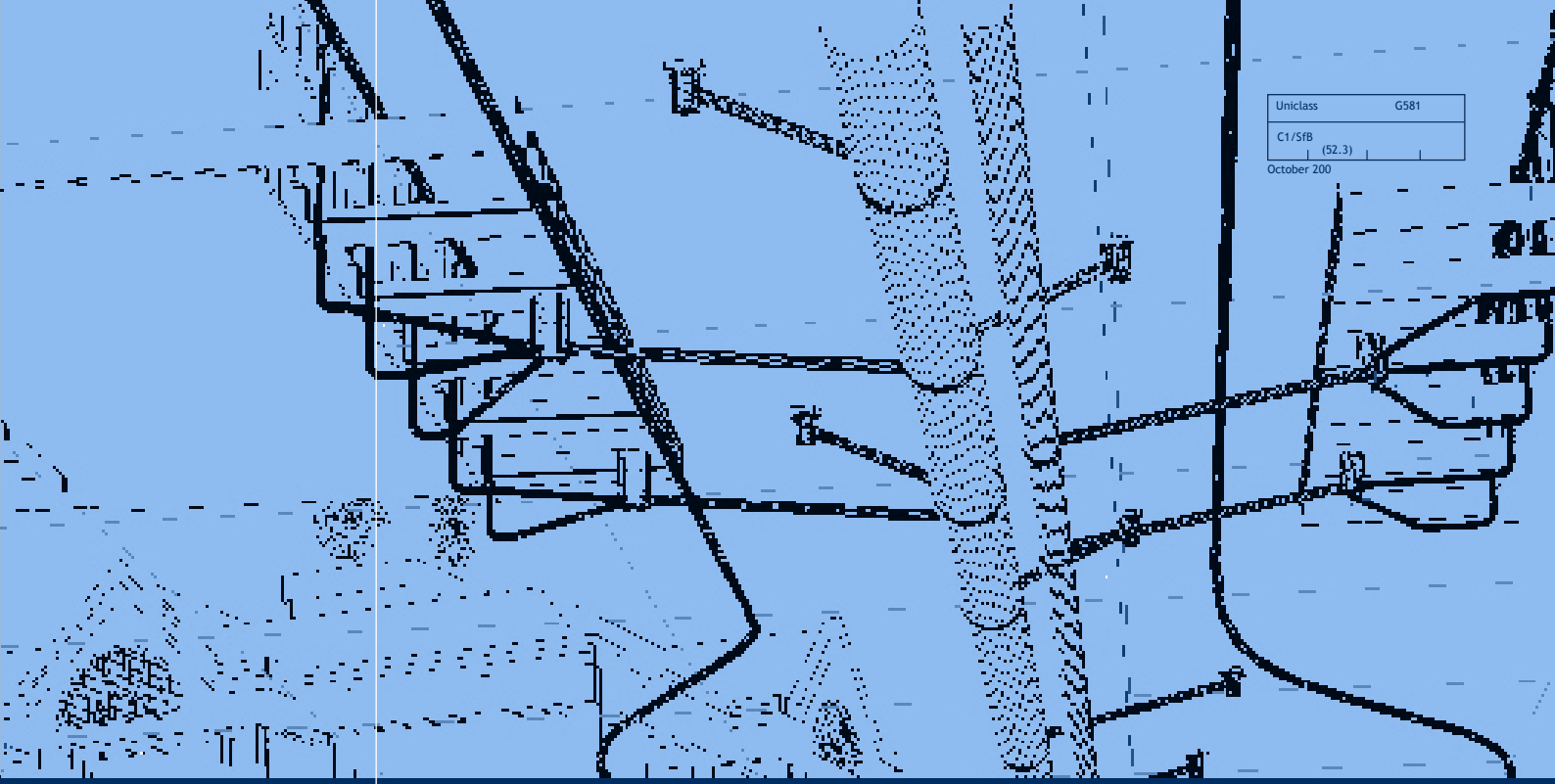

Design and Installation manual

RIDGIDRAIN RIDGISEWER POLYSEWER

advanced drainage system

Polypipe

Company introduction

Polypipe Civils is firmly established as the UK's leading manufacturer of ducting, drainage and environmental systems to the utilities, construction, civil engineering and agricultural industries.

The main product systems manufactured by Polypipe Civils include

- The BBA and HAPAS certified Ridgidrain Advanced Drainage System (ADS) in diameters from 100 to 900mm
- The Ridgisewer and Polysewer gravity sewer systems to WIS 4-35-01
- Manholes, catchpits, soakaways and specialist fabrications in diameters up to 2 metres
- Eco-Vat rainwater harvesting systems
- Ducting systems in a range of types, materials and colours, including the market leading Ridgiduct range
- Ducted access systems
- Landcoil land drainage systems
- Specialist agricultural products
- High visibility fencing
- Extensive range of SUDs solutions
- Polystorm for stormwater management solutions

Our Highest priority is the innovation and development of new and existing products with a continued dedication to the highest standards of quality and customer service. Large research, development and techical support teams have been implemented to support the launch of our ever expanding range of products to the industry.
All products are manufactured within our British Standards Institution accredited quality management to BS EN ISO 9001 and independently certified to British and European standards.

BSI REGISTERED FIRM
Q06225, FM11944, FM318

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Ridgidrain

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Ridgisewer and Polysewer

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General

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STRUCTURED WALL PIPE SYSTEMS

Twin wall pipes are a structured wall alternative to conventional single wall, smooth bore pipes. Twin wall pipes are manufactured by a continuous, twin extrusion process. The outer wall is extruded first, the profile being precisely created by forming into mould blocks with air pressure and vacuum assistance. The inside wall is extruded inside the corrugated outer wall and is fused to the outside wall by compression. The fusion process results in a full strength connection between the inside and outside walls of the pipe.
Manufactured using state-of-the-art equipment, Ridgidrain and Ridgisewer are a stronger, lighter, economic and robust alternative to conventional pipe systems.

The proposed application dictates the choice of system from Polypipe Civils range of structured walled thermoplastic pipes.

Product	Description	Application
Ridgidrain	Surface water drainage	Road, Rail, Airports, Landfill, Sport facilities and Environmental systems
Polysewer Ridgisewer	Gravity surface water and foul sewer systems	Private & adoptable sewer systems, capital work schemes

The different water authorities have varying performance criteria. Polypipe Civils offers a suitable product to meet this criteria.

CONTACTS

Polypipe Civils Division

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Tel: 01509 615125

Utilities / Northwest / Northeast / Ireland

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Estimating Tel: 01509 615126

Estimating Fax: 01509 615153

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sales@polypipecivils.co.uk

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Hydrotub Polypipe S.A.S

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des Petits Eboulis - 77230

Dammartin en Goële, France

Tel: (00 33) 4 02 52 42

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Polypipe Group Head Office

Broomhouse Lane, Edlington, Doncaster,

DN12 1ES

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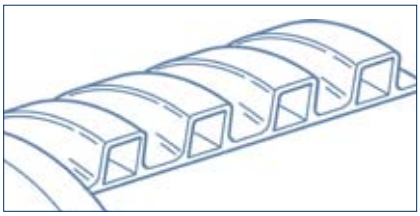
Internet: www.polypipe.com

RIDGIDRAIN

The full Ridgidrain range runs from page 6 - 25

The companies integrated to form Polypipe Civils were each manufacturers of British Board of Agrément (BBA) certified twin wall pipe systems in their own right since the 1980s. One of the first acts of Polypipe Civils was to take the best features from each system and combine them into the fully integrated Ridgidrain twin wall system.

Ridgidrain ADS pipes are manufactured from both high density polyethylene (HDPE) and polypropylene (PP). Although HDPE and PP are from the same family of polymers, HDPE was selected for the smaller diameters due to its greater flexibility and PP was selected as the most economic alternative for achieving high stiffness, large diameter pipes.
All couplings and common fittings are manufactured using precision moulding technology in either HDPE or PP. Seals are manufactured in EPDM as standard with nitrile seals available for special applications.
The ease with which these products can be cut and welded allows them to be used to make a vast range of both standard and made-to-measure fittings, manholes, catchpits and soakaways.



The twin wall structure provides a high stiffness, flexible and economic alternative to conventional designs.

Ridgidrain ADS features

- Full range from 100 - 1050mm *(1050mm BBA Pending)
- Fewer joints means faster installation and less potential for leakage
- Structured wall design for a high ring stiffness
- Optimised weight for reduced health and safety risks and ease of transport, handling and installation.
- Ridgidrain pipes have a weight less than 6% of the equivalent size of concrete pipe
- Strong yet flexible design allows pipeline to withstand some ground movement and differential settlement
- Robust, impact and abrasion resistant construction
- Low friction inner wall for far superior hydraulic performance
- Integral sockets in diameter 400 - 900mm
- A blue inner wall for ease of CCTV surveying and product identification
- Availability in carrier, fully perforated and half perforated (solid invert) configurations
- Easily cut to length without special tools
- Excellent chemical resistance, including sulphates detrimental to ordinary concrete
- Full compliance with the requirements of Building Regulations and the Highways Agency (100 - 900mm only)
- Use of higher performance, virgin polymers for the pipe inner wall
- Independent certification by the British Board of Agrément

BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 00/3678
100 - 900

BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 02/H068
100 - 900

Applications

Airports

The Ridgidrain ADS system is approved by the British Airports Authority for runway and land drainage. Ridgidrain products have also been approved for use on RAF bases and many other airports.

Railways

The Ridgidrain ADS system is approved for track drainage by Railtrack as well as high speed rail operators throughout Europe. Polypipe Civils Limited is a qualified supplier to the industry under the terms of the Link-Up scheme.

- UK Specification: Railtrack plc
- Model Clauses for Specifying Civil Engineering Works
- Sections 185-186
- Track Drainage
- Issue No. 1 Revision B

Link-up

Landfill

There is no industry-wide specification for landfill leachate and methane gas control applications. Ridgidrain ADS products have been widely and successfully used on landfill sites for

- Horizontal basal leachate drainage systems
- Vertical leachate wells
- Horizontal methane gas control systems beneath landfill capping layers
- Vertical methane gas vents
- Cut-off drains

Roads & Highways

By providing an unrivalled product range and holistic solutions, Polypipe can deliver performance and speed to meet customers and ultimately the Highways Agency's tight deadlines. High quality BBA certified products ensure polypipe Civils remains the leader in this market sector.

Sports Fields & Golf Courses

Ridgidrain ADS products are suitable for the drainage of sports fields and golf courses. Recent developments include its use in under pitch heating and moisture extraction systems.

Environmental Systems

Specialist products are easily fabricated from Ridgidrain ADS pipes and fittings. Increasing awareness of the need to protect the quality and the quantity of our water supplies is demanding increasingly sophisticated systems. Ridgidrain ADS is ideally suited for

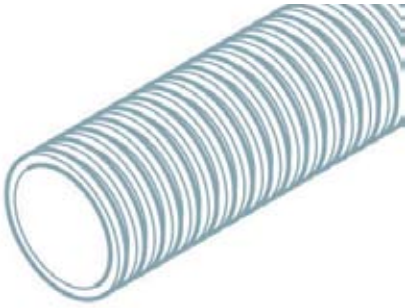
- Horizontal and vertical soakaway systems
- Catchpits
- Manholes
- Pump and sampling chambers
- Stormwater flow attenuation
- Use with petrol and oil separators

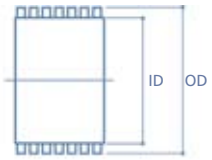
Ridgidrain Pipe Dimensions 1.2

Plain ended carrier drain

One coupling and two seals are required per joint.

NOMINAL SIZE	CODE	ID mm	OD mm	LENGTH m	NOMINAL WEIGHT Kg/m
100	RD100X6PE	100	118	6	0.8
150	RD150X6PE	150	178	6	1.6
225	RD225X6PE	225	267	6	3.6
300	RD300X6PE	300	355	6	5.4
375	RD375X6PE	375	435	6	7.4
400	RD400X6PE	400	457	6	8.2
450	RD450X6PE	450	512	6	10.2
500	RD500X6PE	500	569	6	11.8
600	RD600X6PE	592	674	6	15.5
750	RD750X6PE	766	883	6	34.0
900	RD900X6PE	914	1040	6	46.0
1050*	RD1050X6PE	1065	1215	6	50.0

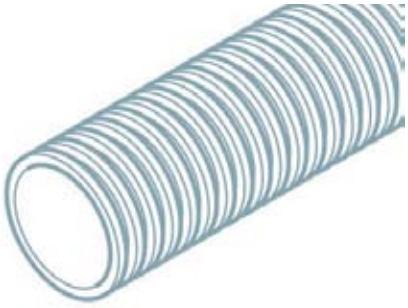


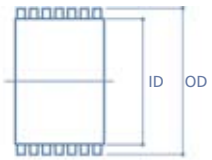


Plain ended filter drain

One coupling is required per joint. Two seals may be required per joint for half perforated (solid invert) pipe.
P = Perforated HP = Half Perforated

NOMINAL SIZE	CODE	ID mm	OD mm	LENGTH m	NOMINAL WEIGHT Kg/m
100	RD100X6PE P or HP	100	118	6	0.8
150	RD150X6PE P or HP	150	178	6	1.6
225	RD225X6PE P or HP	225	267	6	3.6
300	RD300X6PE P or HP	300	355	6	5.4
375	RD375X6PE P or HP	375	435	6	7.4
400	RD400X6PE P or HP	400	457	6	8.2
450	RD450X6PE P or HP	450	512	6	10.2
500	RD500X6PE P or HP	500	569	6	11.8
600	RD600X6PE P or HP	592	674	6	15.5
750	RD750X6PE P or HP	766	883	6	34.0
900	RD900X6PE P or HP	914	1040	6	46.0
1050*	RD1050X6PE P or HP	1065	1215	6	50.0

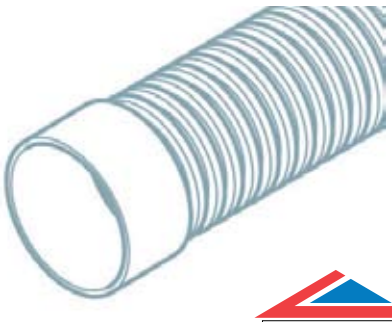


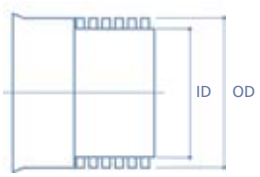


Integrally socketed carrier drain

One seal is required per joint.

NOMINAL SIZE	CODE	ID mm	OD mm	LENGTH m	NOMINAL WEIGHT Kg/m
400	RD400X6	400	457	6	8.2
450	RD450X6	450	512	6	10.2
500	RD500X6	500	569	6	11.8
600	RD600X6	592	674	6	15.5
750	RD750X3	766	883	3	34.0
900	RD900X3	914	1040	3	46.0



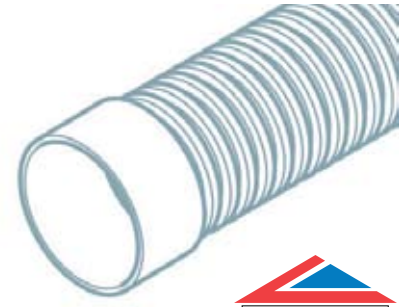


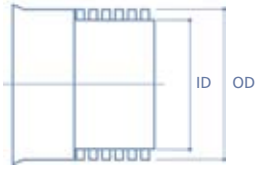
* BBA Pending

Integrally Socketed Filter drain

One seal may be required per joint for half perforated (solid invert) pipe.
P = Perforated HP = Half Perforated

NOMINAL SIZE	CODE	ID mm	OD mm	LENGTH m	NOMINAL WEIGHT Kg/m
400	RD400X6 P or HP	400	457	6	8.2
450	RD450X6 P or HP	450	512	6	10.2
500	RD500X6 P or HP	500	569	6	11.8
600	RD600X6 P or HP	592	674	6	15.5
750	RD750X3 P or HP	766	883	3	34.0
900	RD900X3 P or HP	914	1040	3	46.0



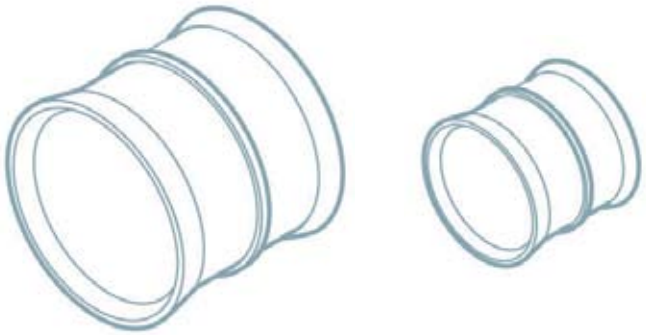


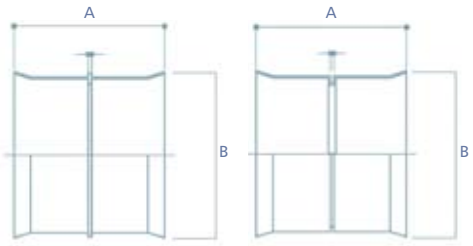
Double Socket Couplings

One coupling and two seals are required per joint.

NOMINAL SIZE	CODE	A	B
100	CRD100	140	133
150	CRD150	185	186
225	CRD225	260	289
300	CRD300	280	379
375	CRD375	335	460
400	CRD400DS	410	490
450	CRD450DS	440	548
500	CRD500DS	490	605
600	CRD600DS	560	713
750	CRD750	600	948
900	CRD900	600	1110
1050*	CRD1050	480	1280

All dimensions in mm





Sealing Rings

EPDM seals to EN681 Part 1. EPDM seals are standard. Optional nitrile seals are available, but may be subject to order quantities and lead times.

NOMINAL SIZE	CODE
100	SRD100
150	SRD150
225	SRD225
300	SRD300
375	SRD375
400	SRD400
450	SRD450
500	SRD500
600	SRD600
750	SRD750
900	SRD900
1050*	SRD1050

* BBA Pending

45° junctions

NOMINAL SIZE A	B	CODE	C	D	E	F
100	100	JRD100100Y*	215	340	70	70
150	100	JRD150100Y*	295	365	95	70
150	150	JRD150150Y*	405	730	95	95
225	100	JRD225100Y	320	520	130	70
225	150	JRD225150Y*	365	520	130	95
225	225	JRD225225Y	575	1055	130	130
300	150	JRD300150Y*	405	560	140	130
300	225	JRD300225Y	620	1050	140	130
300	300	JRD300300Y	690	1310	140	140
375	150	JRD375150Y	445	660	160	95
375	375	JRD375375Y	650	1600	160	160
400	150	JRD400150Y	460	800	205	95
400	400	JRD400400Y	700	1700	205	205
450	150	JRD450150Y	495	880	220	95
450	450	JRD450450Y	900	1400	220	220
500	150	JRD500150Y	540	975	245	95
500	500	JRD500500Y	1050	2000	245	245
600	150	JRD600150Y	575	1120	280	95
600	600	JRD600600Y	1100	2020	280	280
750	150	JRD750150Y	700	1200	Spigot	95
750	750	JRD750750Y	1000	2100	Spigot	Spigot
900	150	JRD900150Y	820	1200	Spigot	95
900	900	JRD900900Y	820	2300	Spigot	Spigot
1050**	150	JRD1050150Y	1020	1400	Spigot	95
1050**	1050	JRD10501050Y	1600	2400	Spigot	Spigot

* = Injection moulded
** BBA Pending

All dimensions in mm

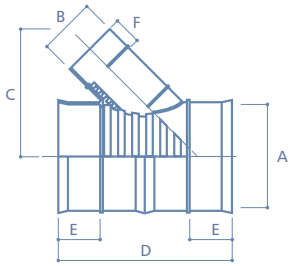
This product selector incorporates dimensions for the most common bends and junctions.

Junctions incorporating other angles and diameters, and bends incorporating other angles are available as specials.

Manholes, catchpits, soakaways, ducting drawpits, pumping chambers and specialist items manufactured to customer specifications are also available.

For further information contact the Technical Department at Polypipe Civils.

Fabricated



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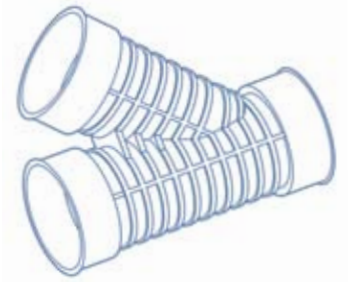
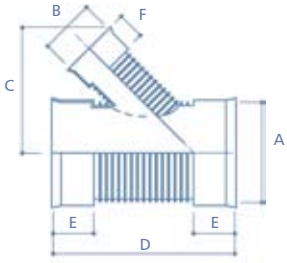




BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 02/H068

BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 00/3678

Check with Polypipe Civils for up to date details on certified products

90° junctions

NOMINAL SIZE

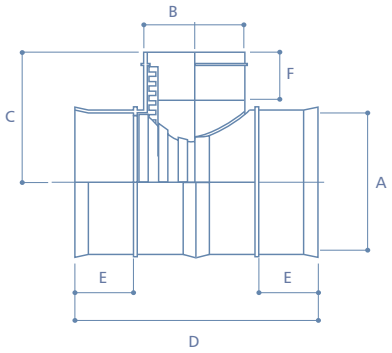
A	B	CODE	C	D	E	F
100	100	JRD100100T*	145	290	70	70
150	100	JRD150100T*	190	425	95	70
150	150	JRD150150T*	210	425	95	95
225	100	JRD225100T	270	520	130	70
225	150	JRD225150T	250	520	130	95
225	225	JRD225225T	455	905	130	130
300	150	JRD300150T	350	560	140	95
300	225	JRD300225T	550	1010	140	130
300	300	JRD300300T	600	1110	140	140
375	150	JRD375150T	350	660	160	95
375	375	JRD375375T	485	915	160	160
400	150	JRD400150T	360	800	205	95
400	400	JRD400400T	720	1500	205	205
450	150	JRD450150T	370	880	220	95
450	450	JRD450450T	835	1670	220	220
500	150	JRD500150T	410	980	245	95
500	500	JRD500500T	950	1840	245	245
600	150	JRD600150T	470	1120	280	95
600	600	JRD600600T	1100	2200	280	280
750	150	JRD750150T	700	1200	Spigot	95
750	750	JRD750750T	1000	1700	Spigot	Spigot
900	150	JRD900150T	820	1200	Spigot	95
900	900	JRD900900T	1200	1900	Spigot	Spigot
1050**	150	JRD1050150T	1020	1400	Spigot	95
1050**	1050	JRD10501050T	1400	2100	Spigot	Spigot

* = Injection moulded

** BBA Pending

All dimensions in mm

Fabricated



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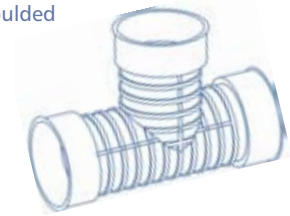
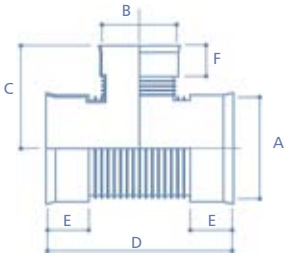




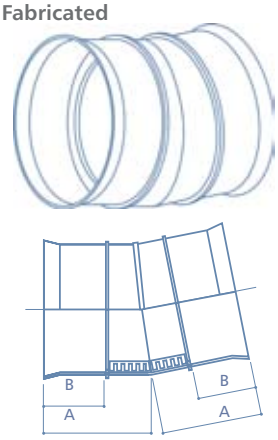
Check with Polypipe Civils for up to date details on certified products

11.25° bends

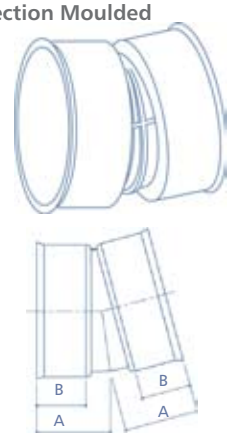
NOMINAL SIZE	CODE	A	B
100	BRD100X11.25	170	95
150	BRD150X15*	95	65
225	BRD225X11.25	190	125
300	BRD300X11.25	265	135
375	BRD375X11.25	300	165
400	BRD400X11.25	375	205
450	BRD450X11.25	415	220
500	BRD500X11.25	490	245
600	BRD600X11.25	535	280
750	BRD750X11.25	600	Spigot
900	BRD900X11.25	800	Spigot
1050**	BRD1050X11.25	1000	Spigot

* Injection Moulded All dimensions in mm
** 1050mm Not BBA certified

Fabricated



Injection Moulded



Check with Polypipe Civils for up to date details on certified products

BBA BRITISH BOARD OF AGREMENT CERTIFICATE No. 02/H068

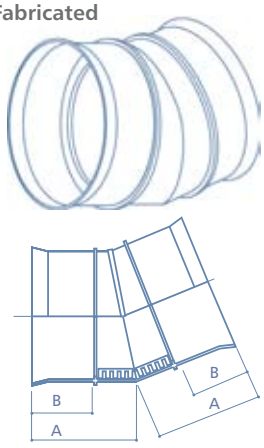
BBA BRITISH BOARD OF AGREMENT CERTIFICATE No. 00/3678

22.5° bends

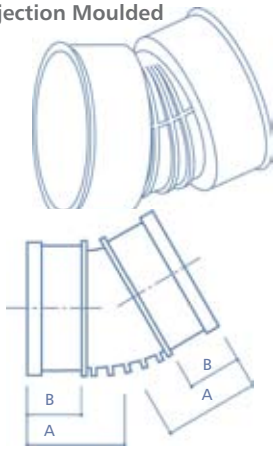
NOMINAL SIZE	CODE	A	B
100	BRD100X22.5	170	95
150	BRD150X30*	130	65
225	BRD225X22.5	260	125
300	BRD300X22.5	255	135
375	BRD375X22.5	310	165
400	BRD400X22.5	395	205
450	BRD450X22.5	460	220
500	BRD500X22.5	465	245
600	BRD600X22.5	535	280
750	BRD750X22.5	700	Spigot
900	BRD900X22.5	900	Spigot
1050**	BRD1050X22.5	1100	Spigot

* Injection Moulded All dimensions in mm
** 1050mm Not BBA certified

Fabricated



Injection Moulded



Check with Polypipe Civils for up to date details on certified products

BBA BRITISH BOARD OF AGREMENT CERTIFICATE No. 02/H068

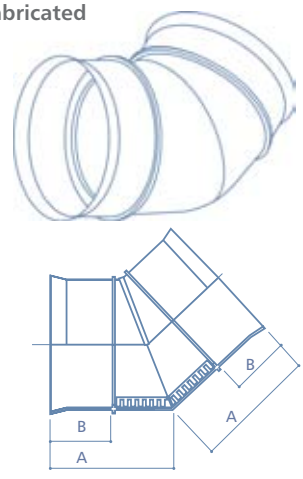
BBA BRITISH BOARD OF AGREMENT CERTIFICATE No. 00/3678

45° bends

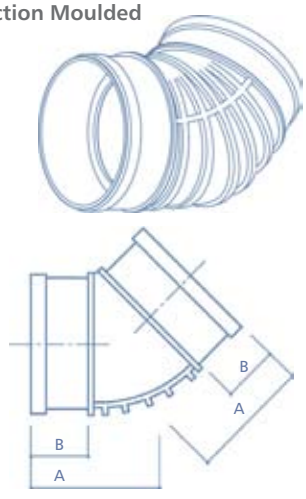
NOMINAL SIZE	CODE	A	B
100	BRD100X45*	185	65
150	BRD150X45*	115	65
225	BRD225X45	270	130
300	BRD300X45	350	140
375	BRD375X45	420	160
400	BRD400X45	460	205
450	BRD450X45	530	220
500	BRD500X45	490	245
600	BRD600X45	560	280
750	BRD750X45	800	Spigot
900	BRD900X45	1000	Spigot
1050**	BRD1050X45	1200	Spigot

* Injection Moulded All dimensions in mm
** 1050mm Not BBA certified

Fabricated



Injection Moulded



Check with Polypipe Civils for up to date details on certified products

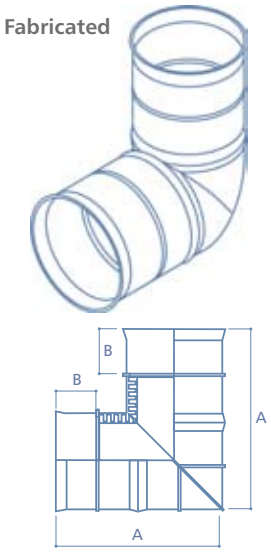
BBA BRITISH BOARD OF AGREMENT CERTIFICATE No. 02/H068

BBA BRITISH BOARD OF AGREMENT CERTIFICATE No. 00/3678

90° bends

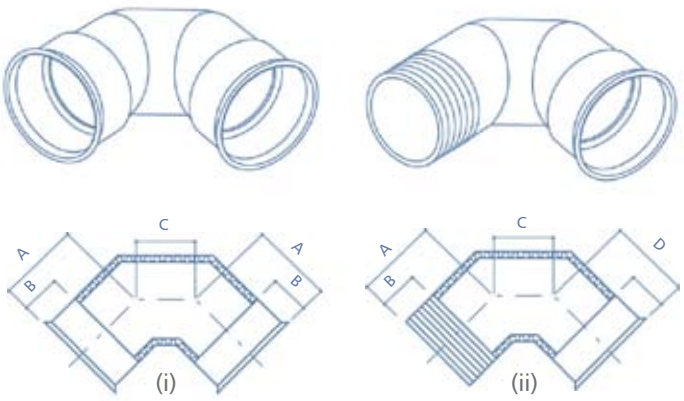
NOMINAL SIZE	CODE	A	B
100	BRD100X87.5*	260	65
150	BRD150X87.5*	375	90
225	BRD225X90	540	130
300	BRD300X90	590	140
375	BRD375X90	960	160
400	BRD400X90	780	205
450	BRD450X90	850	220
500	BRD500X90	985	245
600	BRD600X90	1120	280
750	BRD750X90	1000	Spigot
900	BRD900X90	1200	Spigot
1050**	BRD1050X90	1400	Spigot

* Injection Moulded All dimensions in mm
** 1050mm Not BBA certified



90° lobster back bends

NOMINAL SIZE	CODE	A	B	C	D
225	BLBRD225X90	384	135	417	Spigot
300	BLBRD300X90	394	134	507	Spigot
375	BLBRD375X90	463	269	620	Spigot
400	BLBRD400X90	411	196	646	Spigot
450	BLBRD450X90	441	215	667	Spigot
500	BLBRD500X90	488	250	687	Spigot
600	BLBRD600X90	533	275	728	Spigot
750	BLBRD750X90	738	440	818	658
900	BLBRD900X90	770	440	882	690

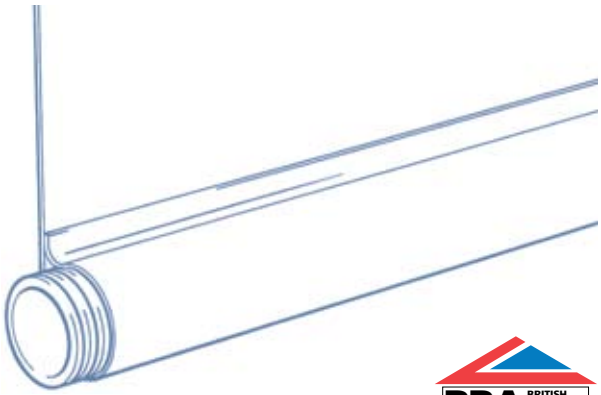


Type 6 fin drain

Single wall corrugated pipe to BS 4962:1989 supplied assembled with plastic fin and wrapped in geotextile.
Available in 80, 100 and 160mm diameters. Insert required diameter in place of 'L' in product code.
These items are made to order and are subject to lead times. Minimum order - 10 packs per size.

CODE	DEPTH mm	LENGTH m
FDLX12.5X600	600	12.5
FDLX12.5X700	700	12.5
FDLX12.5X800	800	12.5
FDLX12.5X900	900	12.5
FDLX12.5X1000	1000	12.5
FDLX12.5X1100	1100	12.5
FDLX12.5X1200	1200	12.5
FDLX12.5X1500	1500	12.5
FDLX12.5X1930	1930	12.5

Type 6 is also available in 50m lengths with integral draw string for insertion of pipe on site.



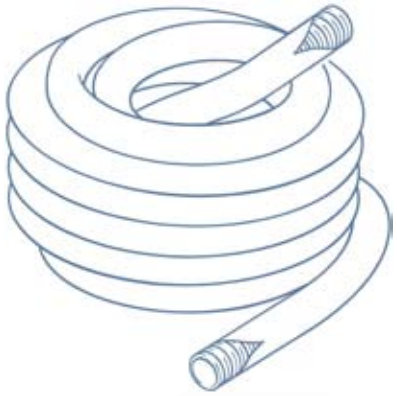
Ridgidrain Pipe Dimensions 1.2

Type 8 filter drain

Single wall corrugated pipe to BS 4962:1989.
Supplied wraped in geotextile.

CODE	DIAMETER mm	LENGTH m
GE60X150	60	150
GE80X100*	80	100
GE100X100*	100	100
GE125X75	125	75
GE160X45	160	45
GE200X40	200	40

* Available from stock

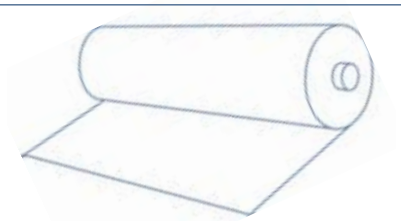


BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 93/R078

up to 100mm

Type 9 geotextile sheet

CODE	DEPTH mm	LENGTH mm
TX4.5X100	4.5	100



BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 93/R078

Ridgigully HDPE road gully

Corrugated for extra strength

CODE	NOMINAL DIAMETER mm	NOMINAL DEPTH mm	CAPACITY LITRES
RG450750	450	750	80
RG450900	450	900	104

Gully adaptors

Code	Description
UG602	160mm BS4660 coupler
ARGMulti	Multi-adaptor

BS4660 Coupler

Multi-adaptor

BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 90/R054

Midi-gully HDPE gully

Corrugated for extra strength

CODE	NOMINAL DIAMETER mm	DEPTH mm	CAPACITY LITRES
RG300600	300	600	24

Accessories

Code	Description
UG402	110mm BS4660 adaptor
RGSB	Silt Bucket
RGG	Grating

Grating

BS4660 Coupler

Silt bucket

Lubricant

CODE	QUANTITY kg
LUBX1	1
LUBX2.5	2.5

Lubricant must be used for all sealed joints

Ridgiflex gully connection pipe

Corrugated for extra strength

CODE	NOMINAL SIZE mm	LENGTH m
RF150X25	150	25

Pipe detail specifications

A recent addition to the Manual Contract Document of Highway Works; Volume 1, Series 500, is clause 518. This clause specifies a comprehensive range of performance and structural requirements for thermoplastic structured walled pipes and fittings, summerised in the table below:

PROPERTY	STANDARD
Ring Stiffness	BS EN ISO 9969
Creep Ratio	BS EN ISO 9967
Impact resistance	BS EN 1411 (with d25 stricker of 1Kg)
Leaktightness of joints - Distortion	BS EN ISO 1277
Leaktightness of joints - Deflection	BS EN ISO 1277
High volume low pressure jetting	WRc Jetting Test Method
Longitudinal bending	MCDHW Clause 518.11
Rodding resistance	MCDHW Clause 518.12

Extracted from Manual Contract Documents of Highway Works; Volume 1, Series 500, Table 5/9.

In addition to being manufactured, under a BS EN ISO 9001:2000 quality management system, Ridgidrain ADS has undergone extensive testing by third parties, resulting in the following certification:

- Building Regulations — BBA Certificate No. 00/3678
- HAPAS — BBA Certificate No. 02/H068

Ridgidrain ADS pipes are manufactured in carrier drain, fully perforated filter drain and half perforated (solid invert) filter drain configurations as standard. Contact the Technical Department at Polypipe Civils for details of custom slotting options for specialist applications.

Ridgidrain ADS filter drainage pipes provide a much greater perforated area than the minimum requirement of 1000mm² of perforations per metre length, as specified in Volume 1 of the Manual of Contract Documents for Highway Works.

Table 1.3.1 Filter drain perforation specification 100 - 600mm

NOMINAL SIZE mm	SLOT WIDTH mm	PERFORATED AREA PER METER mm²/m
100	1.0 - 2.0	2400 min
150	1.0 - 2.5	3120 min
225	1.0 - 2.7	3000 min
300	1.0 - 3.4	4800 min
375	1.5 - 3.6	6000 min
400	3.0 - 4.0	8400 min
450	3.0 - 4.0	10920 min
500	3.0 - 4.0	9240 min
600	3.0 - 4.0	9140 min

* The above values are for full circumferentially perforated pipes. The number of perforations and the total perforated area should be halved for solid invert pipes.

Table 1.3.2 Filter drain perforation specification 750 - 900mm

NOMINAL SIZE mm	SLOT WIDTH mm	PERFORATED AREA PER METER mm²/m
750	3 - 4	9720 min
900	3 - 4	9720 min

The above values are for full circumferentially perforated pipes. The number of perforations and the total perforated area should be halved for half perforated (solid invert) pipes. (Rough guide only).

Flotation

Although unlikely to occur, the potential for flotation should be checked in installations where the water table is above the pipe invert level. Table 1.4.1 details uplift forces for the following conditions:

Pipe bore empty

This is applicable to empty carrier drainage systems.
The uplift forces are due to air trapped within the corrugations and the pipe bore.

Pipe bore full

This is applicable to filter drainage pipes and filled carrier drainage pipes.
The uplift forces are due to air trapped within the corrugations.

Table 1.4.1 Uplift Forces for Fully Submerged Pipes

DIAMETER (mm)	PIPE BORE FULL (kN/m)	PIPE BORE EMPTY (kN/m)
100	0.013	0.090
150	0.030	0.201
225	0.068	0.458
300	0.136	0.829
375	0.187	1.253
400	0.191	1.393
450	0.250	1.775
500	0.321	2.216
600	0.466	3.129
750	0.704	5.225
900	0.823	7.260
1050	1.191	9.930

N.B. Fluid density of 1000kg/m^3 assumed. An appropriate factor of safety should be used to ensure prevention of floatation after installation. Please note, Ridgidrain pipes may float if a substantial depth of water is in the trench during installation.

Structural Properties

Where a detailed structural design check to determine the installed performance of the Ridgidrain system is to be carried out, values from tables 1.4.2 & 1.4.3 may be used for design purposes. Please refer to Section 3.2 for structural design methodology of flexible pipe systems

Table 1.4.2 Short-Term Pipe Design Properties

NOMINAL SIZE (mm)	MEAN DIAMETER (m)	I ($m^4/m \times 10^{-9}$)	E ($kN/m^2 \times 10^{3)}$)	EI/D^3 (kN/m^2)
150	0.158	47.2	800	9.43
225	0.239	113.7	800	6.62
300	0.320	264.7	800	6.41
375	0.395	543.7	800	7.05
400	0.417	486.9	1100	7.38
450	0.471	699.3	1100	7.34
500	0.525	934.3	1100	7.07
600	0.622	1324.1	1100	6.04
750	0.811	3820.2	2800	19.98
900	0.950	3125.9	2800	10.20
1050	1.118	6510.4	2800	13.04

Structural Properties

Table 1.4.3 Long term pipe design properties

NOMINAL SIZE (mm)	MEAN DIAMETER (m)	I ($m^4/m \times 10^{-9}$)	E ($kN/m^2 \times 10^3$)	EI/D^3 (kN/m^2)
150	0.158	47.2	230	2.71
225	0.239	113.7	230	1.90
300	0.320	264.7	230	1.84
375	0.395	543.7	230	2.03
400	0.417	486.9	280	1.88
450	0.471	699.3	280	1.87
500	0.525	934.3	280	1.80
600	0.622	1324.1	280	1.54
750	0.811	3820.2	580	4.14
900	0.950	3125.9	580	2.11
1050	1.118	6510.4	580	2.70

Installation of the Ridgidrain system is typically carried out in accordance with the Manual Contracts Documents of Highway works (MCDHW).
The following standard details reference the MCDHW and illustrate pipe bed and surround requirements for carrier or filter drain installation.

Standard details

Granular pipe bed and surround material, consisting of natural and/or recycled coarse aggregate or recycled concrete aggregate, should have the following specification (in accordance with clause 503.3 MCDHW).

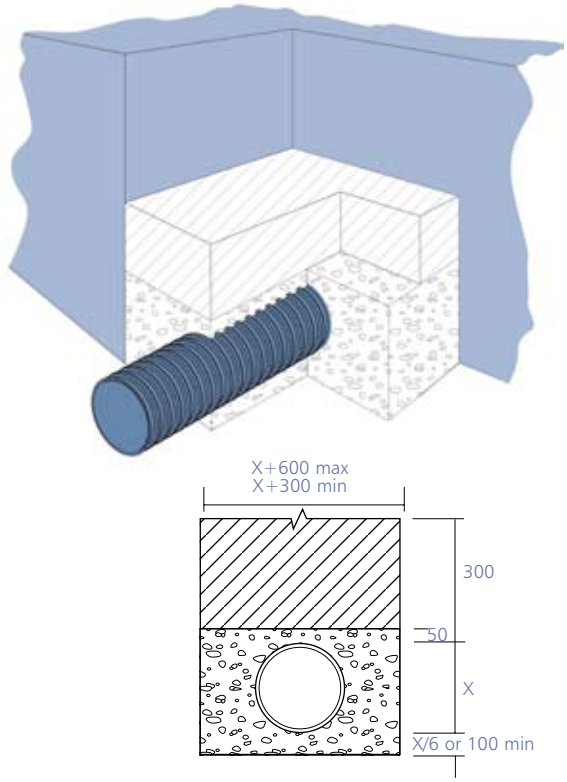
For pipes on beds shown on HCD Drawing Number F1 as Types B, F and S
BS EN 13242, Coarse aggregate (clause 4.3.2)

	Aggregate size, mm	
Nominal pipe diameter, mm	Graded	Single Size
Up to 140		4/10
> 140 to 400	2/14 or 4/20	4/10, 6/10 or 10/20
> 400	2/14, 4/20 or 4/40	4/10, 6/14, 10/20 or 20/40

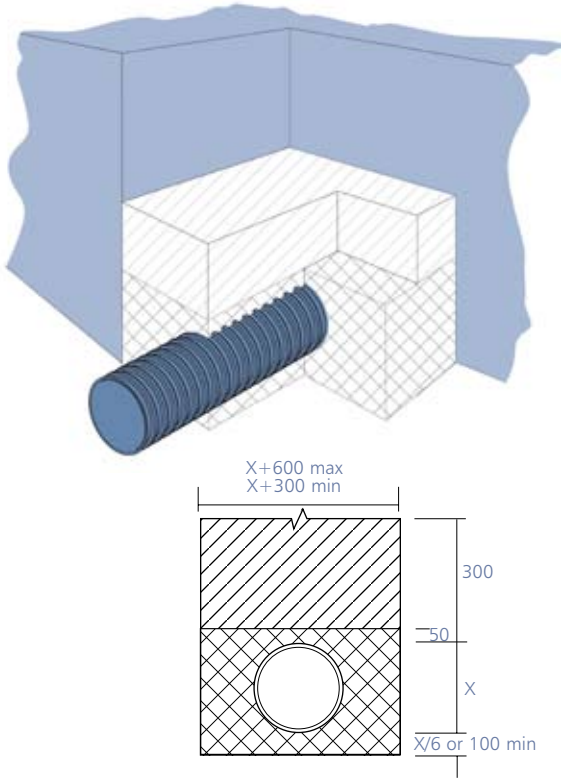
(a) Category for general grading requirements – G_c80-20
(b) Category for maximum values of fines content
i) Gravel – f1.5
ii) Crushed rock, recycled aggregate – f4
(c) A resistance to fragmentation in Category LA50 in accordance with BS EN 13242, clause 5.2 and Table 9;
(d) A water-soluble sulfate content of less than 1.9 grams of sulfate (as SO3) per litre when tested in accordance with BS EN 1744-1, clause 10;
(e) All other requirements in Category NR.

Standard details to the manual of contract document for highway works

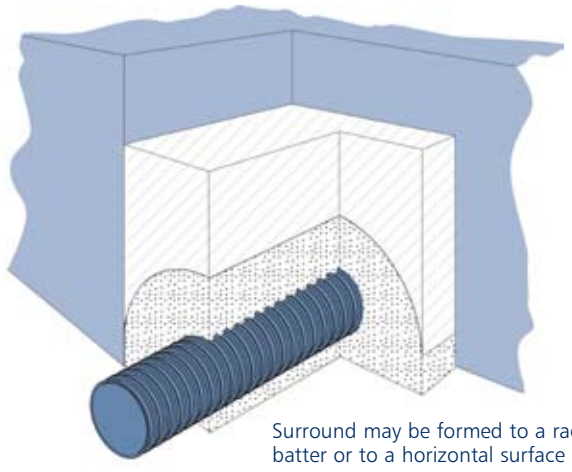
Type S Surface water carrier drains



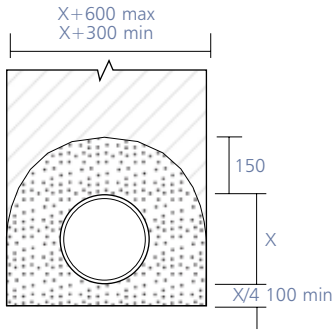
Type T Surface water carrier drains



Type Z Surface water carrier drains



Surround may be formed to a radius batter or to a horizontal surface



- Type S is the preferred granular bed and surround detail
- Type Z is recommended where depths of cover are less than 1.2m. Joint filler board shall be placed in contact with the end of the socket at a pipe joint and shall extend through the full thickness of the concrete in contact with the pipe. These should be placed at each pipe joint.

Class 8 material to S.H.W. Clause 503.3 (iv)

Concrete to S.H.W. Clause 503.3 (iii)

Granular material to S.H.W. Clause 503.3(i)

Material to S.H.W. Clause 503.3(ii) e.g. sand

In situ soil

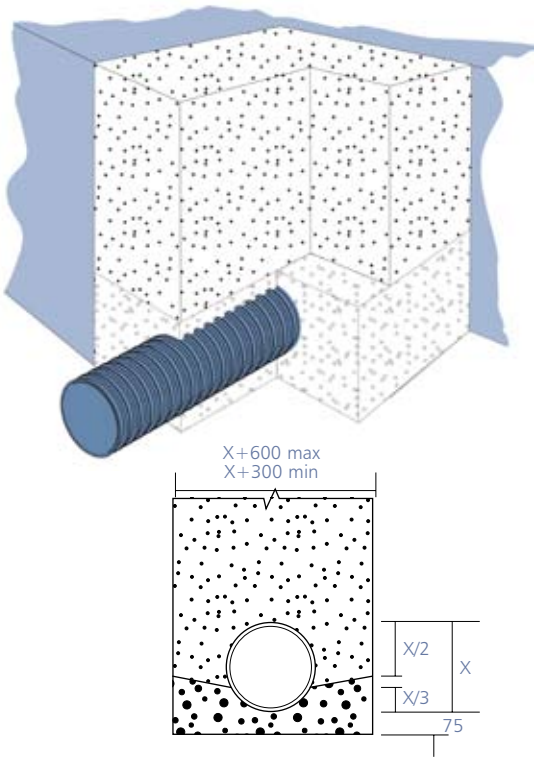
SHW = Specification for Highway Works

All dimensions in mm

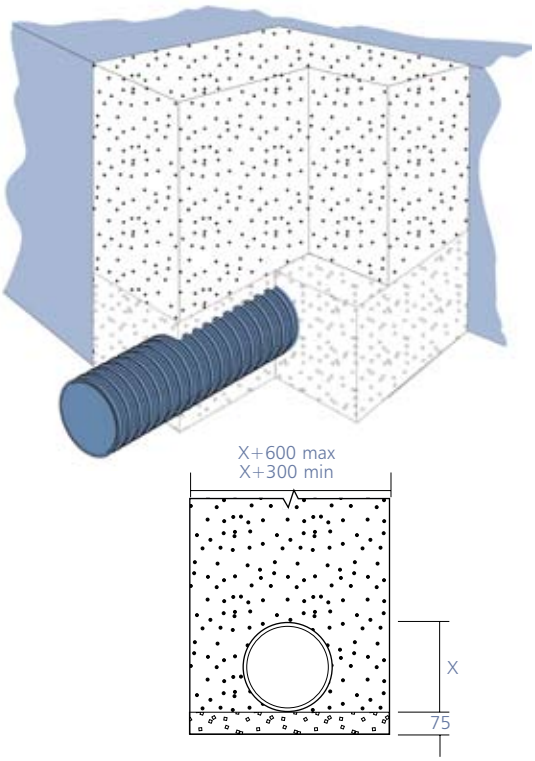
X = pipe diameter

Standard details to the manual of contract document for highway works

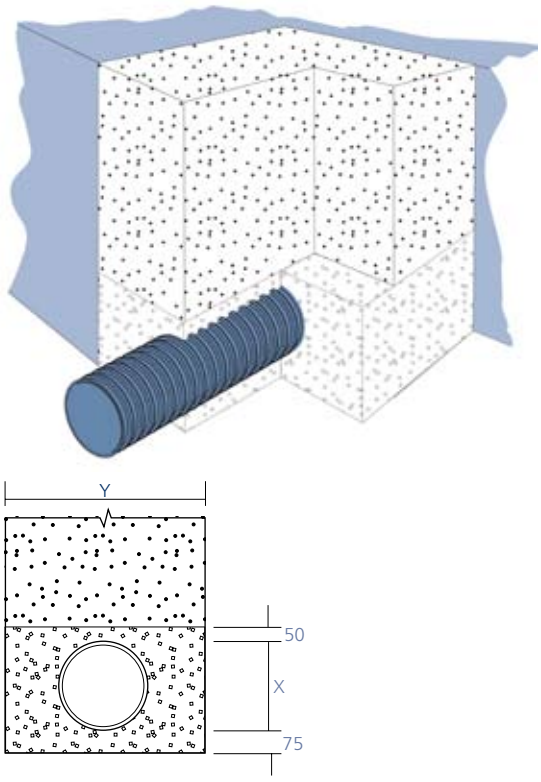
Type G Filter drains



Type H Filter drains



Type I Filter drains



Type B filter material to SHW Clause 505

Mix ST2 concrete

Type A or C filter material to S.H.W. Clause 505 or granular material to S.H.W. Clause 503.3(i)

In situ soil

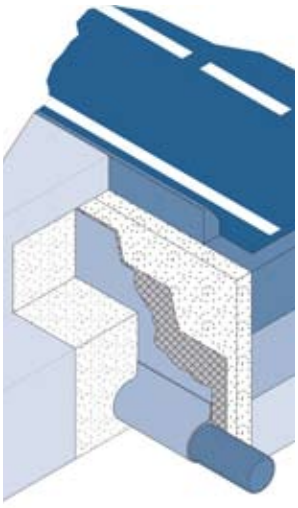
SHW = Specification for Highway Works

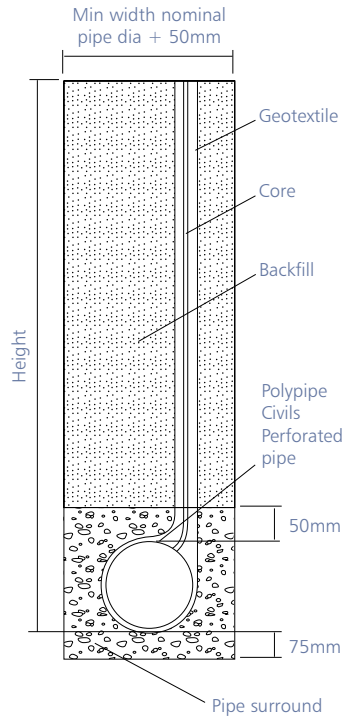
All dimensions in mm

X = pipe diameter

Standard details

Type 6 Fin drain



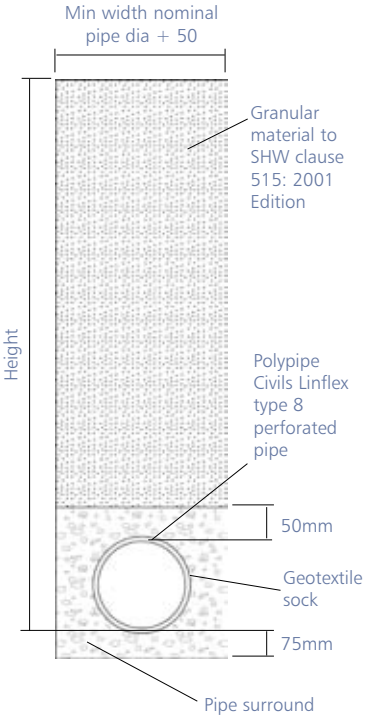


Surround and backfill material to S.H.W. Clause 515

In situ soil

BBA BRITISH BOARD OF AGREMENT CERTIFICATE No. 93/R078

Type 8 Narrow filter drain

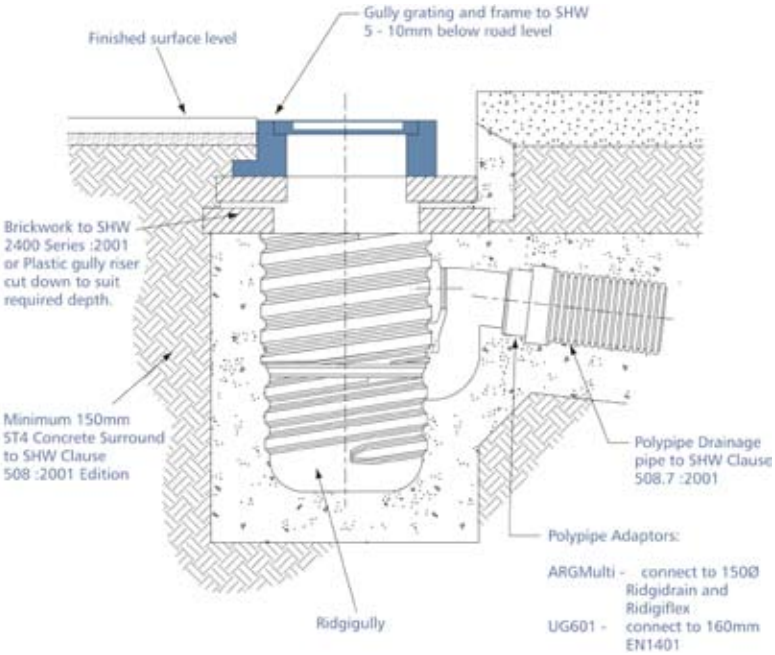


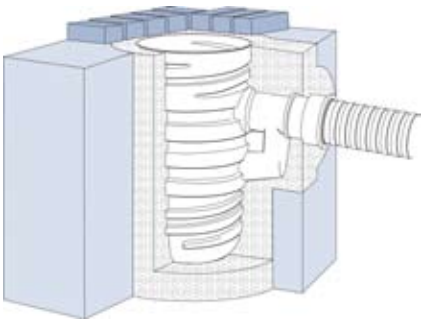
Surround and backfill material to S.H.W. Clause 515

In situ soil

BBA BRITISH BOARD OF AGREMENT CERTIFICATE No. 93/R078

Ridgigully


Finished surface level
Gully grating and frame to SHW 5 - 10mm below road level
Brickwork to SHW 2400 Series :2001 or Plastic gully riser cut down to suit required depth.
Minimum 150mm ST4 Concrete Surround to SHW Clause 508 :2001 Edition
Polypipe Drainage pipe to SHW Clause 508.7 :2001
Polypipe Adaptors:
ARGMulti - connect to 150Ø Ridgidrain and Ridigiflex
UG601 - connect to 160mm EN1401
Ridgigully



Optional gully rising sections may be used with a concrete surround in place of brickwork.

Surround and backfill material to S.H.W. Clause 515

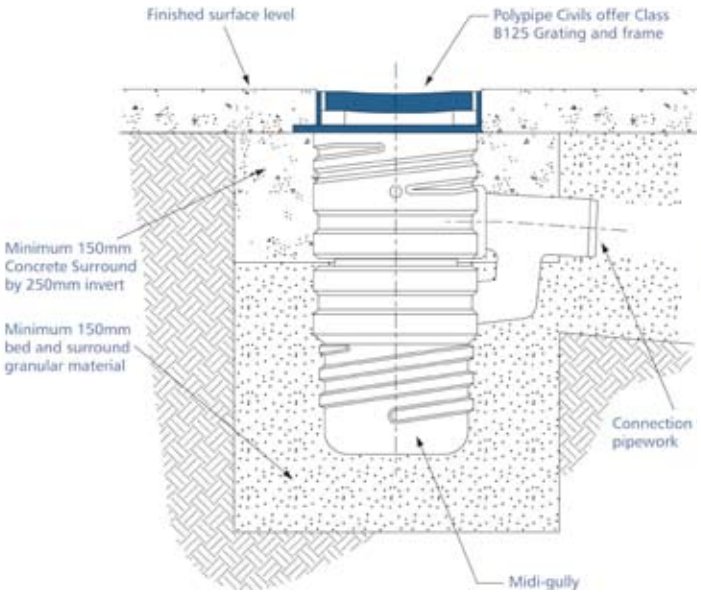
Surround and backfill material to S.H.W. Clause 514

Concrete to S.H.W. Clause 508.6

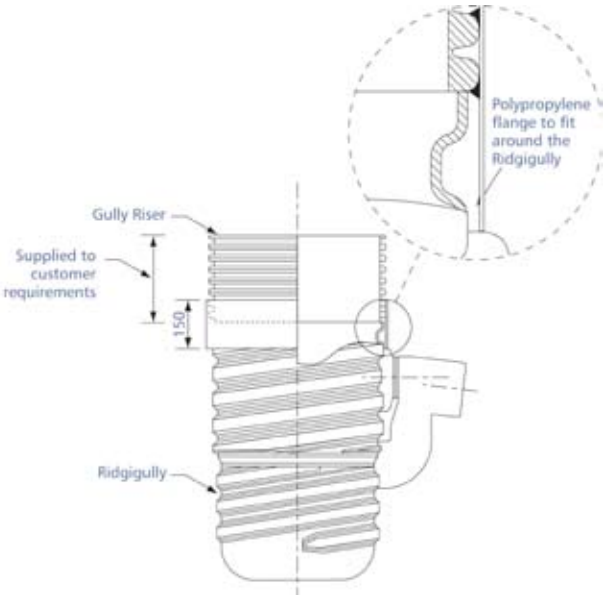
In situ soil

BBA BRITISH BOARD OF AGREMENT CERTIFICATE No. 90/R054

Midi-gully

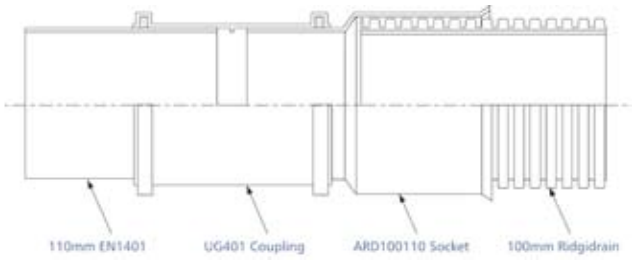

Finished surface level
Polypipe Civils offer Class B125 Grating and frame
Minimum 150mm Concrete Surround by 250mm invert
Minimum 150mm bed and surround granular material
Connection pipework
Midi-gully

Gully Riser

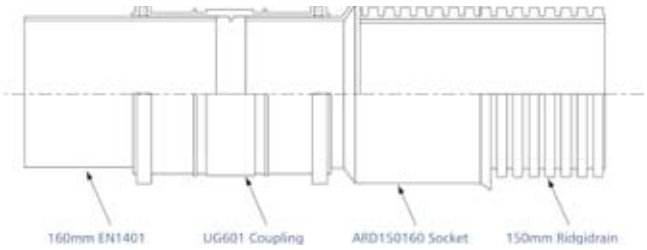


Standard connections

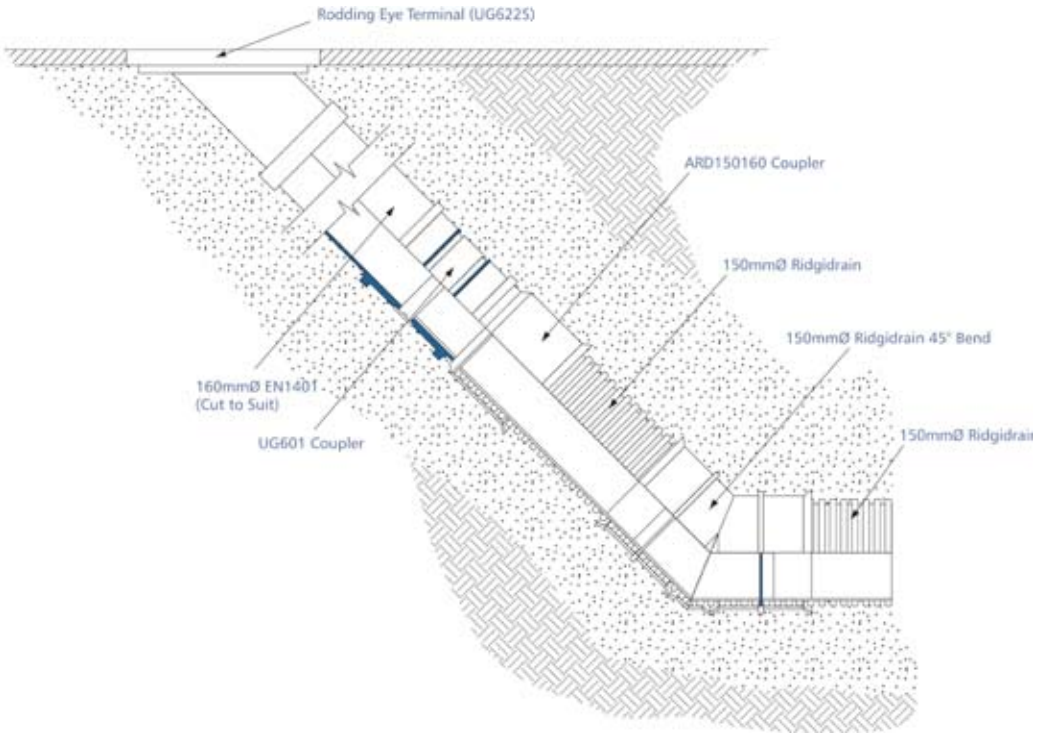
Connection 110mm EN1401 to 100mm Ridgidrain



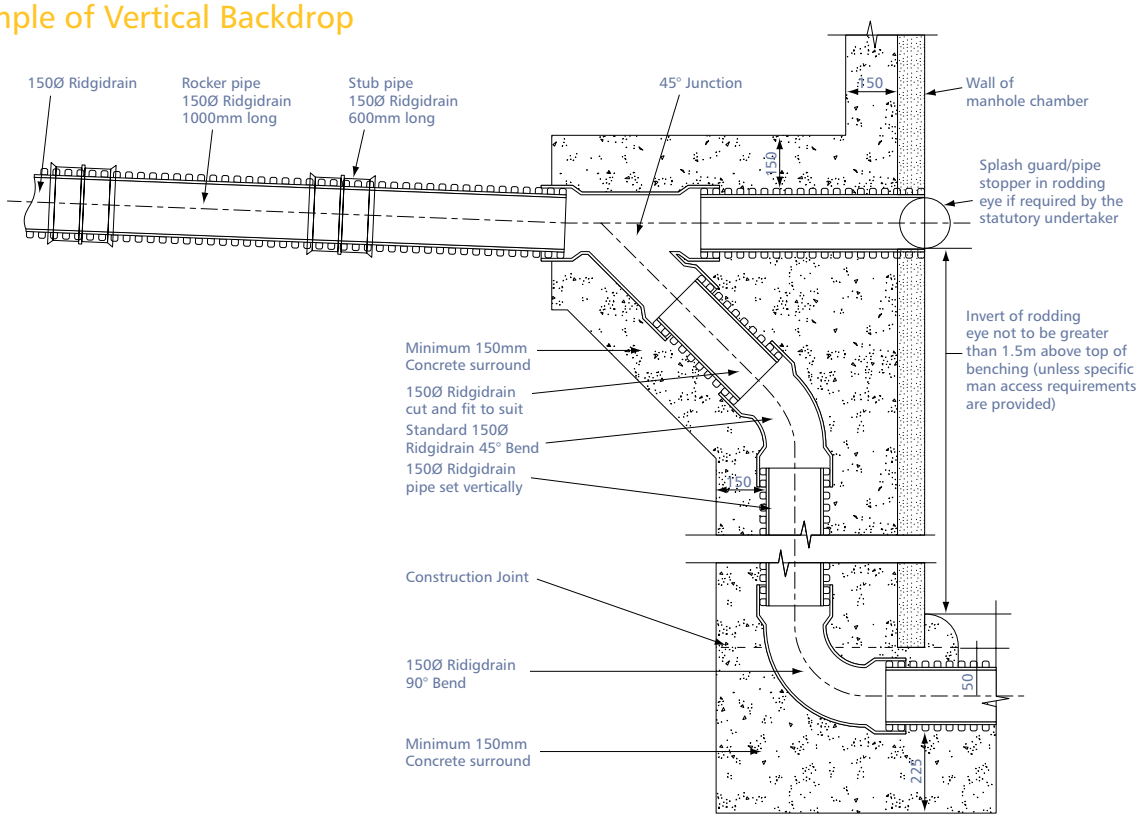
Connection 160mm EN1401to 150mm Ridgidrain



Rodding eye connections

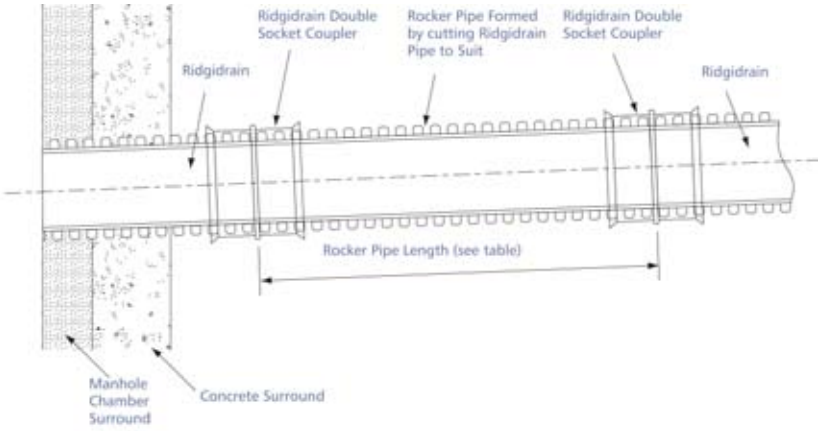


Example of Vertical Backdrop

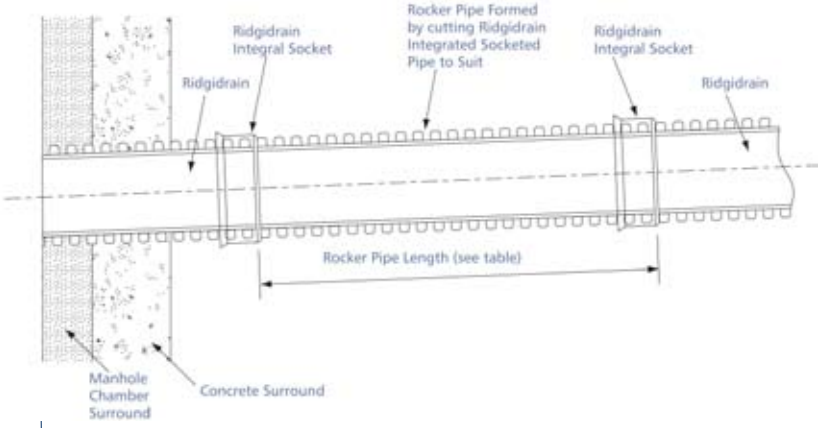


Rocker pipe detail

Double Socket Coupler Option



Integral Socketed Pipe Option



Polypipe Civils believe that the Ridgidrain Advanced Drainage System reduces the effect of differential settlement, rocker pipes would only be required where abnormal settelment is expected.

Provisions outlined in the relevant code of practice should be followed with respect to rocker pipe requirements. In the absence of a specification we would draw your attention to BS 5955: Part 6: 1980; 'Plastic Pipework (Thermoplastic materials) Part 6 - Code of practice for the installation of plasticized PVC pipework for gravity drains and sewers."

Clause 7.3 states "The provision of at least one flexible joint is recommended within 300mm of the external face of the wall of any building and at each point of all manholes and inspection chambers.
Where abnormal settlement is expected, it is advisable to incorporate two flexible joints to form a 'rocker' length of pipe."

Sewers for adoption, Edition 6; Clause 4.6.6 recommends the length of rocker pipe required adjacent to structures. Detailed in the table below:

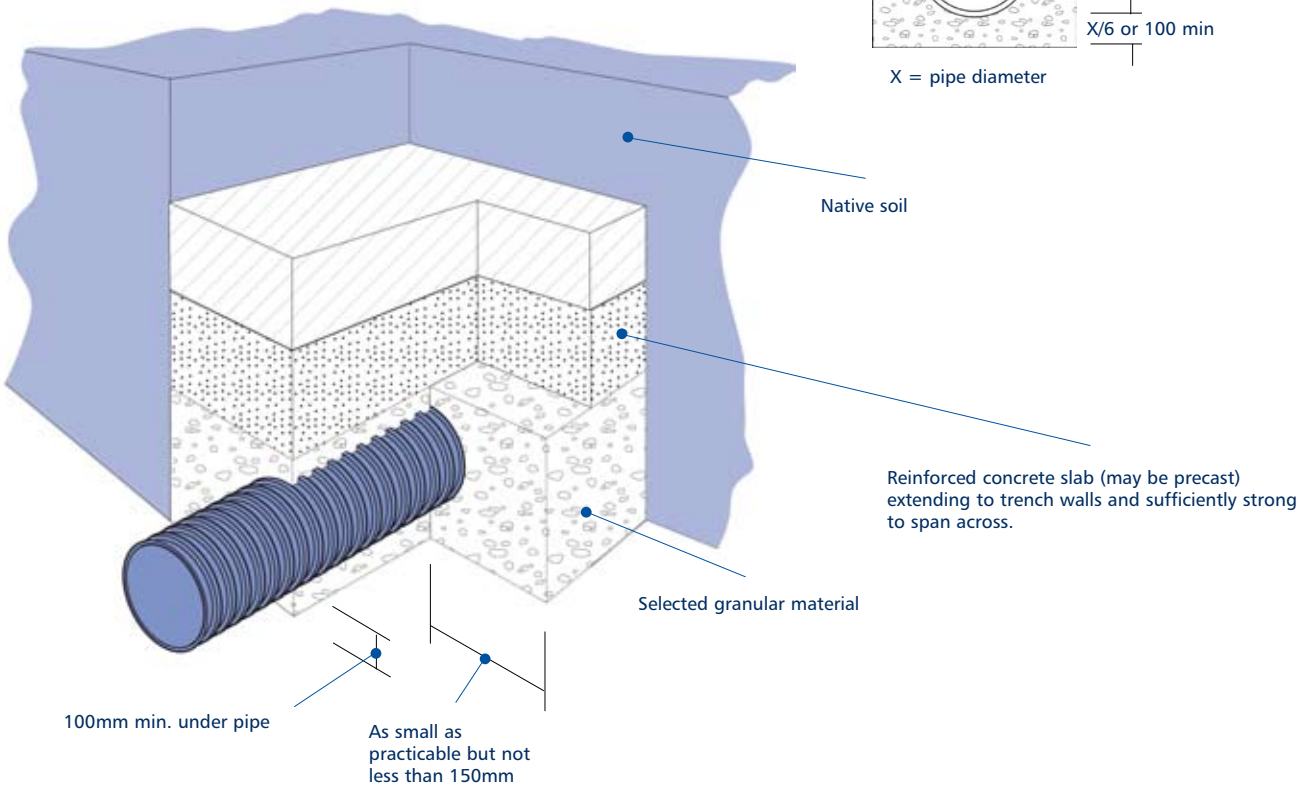
Pipe Diameter (mm)	Min. Rocker Pipe Length, L (m)
150 to 600	0.600
675 to 750	1.000
Over 750	1.250

Special protective measures

Protective measures are suggested where depths of cover are less than recommended (see section 3.1) or where loading is excessive. This may take the form of either a concrete slab or concrete bed and surround.

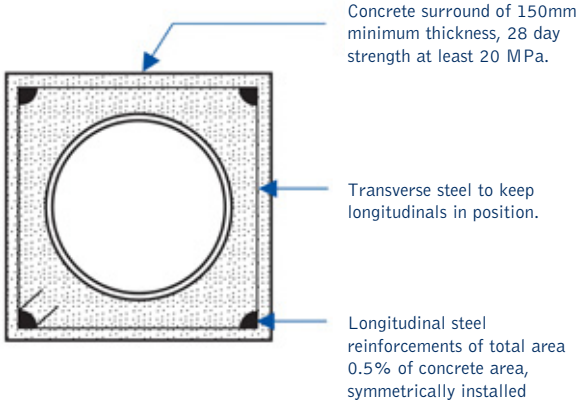
Concrete Covering Slab

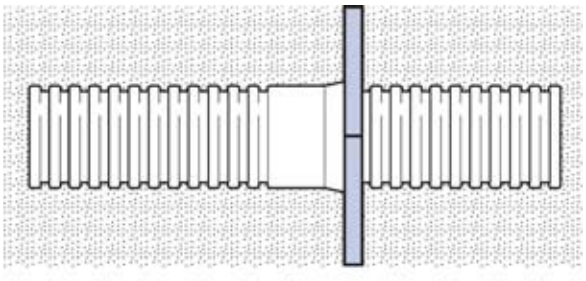
This detail is preferable to a concrete bed and surround because the flexibility of the pipe system is maintained.


X+600 max
X+300 min
100
X/6 or 100 min
X = pipe diameter
Native soil
Reinforced concrete slab (may be precast) extending to trench walls and sufficiently strong to span across.
Selected granular material
100mm min. under pipe
As small as practicable but not less than 150mm

Concrete Bed and Surround

A concrete bed surround is not preferred as it creates a concrete ground beam of relatively low flexural strength.


Concrete surround of 150mm minimum thickness, 28 day strength at least 20 MPa.
Transverse steel to keep longitudinals in position.
Longitudinal steel reinforcements of total area 0.5% of concrete area, symmetrically installed



Joint filler board should be placed in contact with the end of the socket at a pipe joint and should extend through the full thickness of the concrete in contact with the pipe. Flexible joints shall be at intervals of 5m or at each joint, whichever is the greater.

Ridgidrain Infiltration 1.6

Infiltration Devices

Sustainable Urban Drainage Systems (SUDS) is becoming more prevalent in drainage design [Please refer to Polypipe Stormwater management technical manual]. One key SUDS technique is to encourage surface water to infiltrate into the ground at source.

The Ridgidrain pipe system is available in unperforated, half-perforated and fully perforated configurations. The perforated and half-perforated pipes may be used to form several different infiltration devices. With carrier pipes used to transport surface water to the point of infiltration, enabling a single integrated system to be used, where required.

Typical infiltration structures, using the Ridgidrain system, are:

- Ring soakaway
- Horizontal tank soakaway
- Trench soakaway
- Infiltration trench
- As part of a drainage blanket (increasing its storage capacity and reducing the volume of stone required)

Please refer to Polypipe Stormwater Management Technical Manual for further information of SUDS and infiltration structure design.

Ridgidrain Model Specification Clauses 1.7

Ridgidrain ADS Filter / Carrier Drainage Pipes For applications subject to the Manual of Contract Documents for Highway Works in diameters up to 900mm

The pipes shall be thermoplastic structured wall pipes and shall have a current British Board of Agrément Building Regulations or HAPAS certificate stating that they comply with volume 1, clause 518 of the Manual of Contract Documents for Highway Works. The system shall be stored, handled, transported and installed in accordance with the Manual of Contract Documents for Highway Works. The pipes shall be of carrier / fully perforated / half perforated (solid invert) configuration. Solid invert and carrier drainage pipe shall be installed with sealed joints. Diameters 450mm and greater shall incorporate a factory fitted integral socket. The pipe shall have a blue inner wall to facilitate CCTV surveying.

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Ridgidrain ADS Carrier Drainage Pipes For applications subject to the Building Regulations in diameters up to 900mm

The pipes shall be thermoplastic structured wall pipes and shall have a current British Board of Agrément certificate stating that they are suitable for the drainage of surface waters. The system shall be stored, handled, transported and installed in accordance with the provisions of BS 5955: Part 6: 1980. The system shall be installed with sealed joints. Diameters 450mm and greater shall incorporate a factory fitted integral socket. The pipe shall have a blue inner wall to facilitate CCTV surveying.

Ridgidrain ADS Filter / Carrier Drainage Pipes In diameters greater than 900mm

The pipes shall be thermoplastic structured wall pipes and shall meet the impact Clause NG501.2 of the Manual of Contract Documents for Highway Works. The pipes shall have a stiffness greater than $8kNm^{-2}$ to BS EN ISO 9969. The system shall be stored, handled, transported and installed in accordance with BS 5955: Part 6: 1980. The pipes shall be of carrier / fully perforated / half perforated (solid invert) configuration. Solid invert and carrier drainage pipe shall be installed with sealed joints. Diameters greater shall incorporate a factory fitted integral socket. The pipe shall have a blue inner wall to facilitate CCTV surveying.

Ridgigully

The surface water gullies shall be single piece gullies moulded in HDPE and shall have a current British Board of Agrément Roads and Bridges certificate. The outlet shall be trapped as standard and capable of being converted to an untrapped gully by removal of the factory installed stopper. The gully shall be corrugated for enhanced stiffness and to key into the concrete surround. Gullies shall be installed in accordance with the Manual of Contract Documents for Highway Works.

Ridgidrain Fin Drain (Type 6)

Fin drains shall be of Type 6 or Ridgidrain and shall have a current British Board of Agrément Roads and Bridges certificate. The pipe shall be kitemarked to BS4962:1989 and the geotextile shall be non-woven and meet the requirements of the Manual of Contract Documents for Highway Works.

Ridgidrain Fin and Narrow Filter (Type 8)

Narrow filter drains shall be of Type 8 and shall have a current British Board of Agrément Roads and Bridges certificate. The pipe shall be kitemarked to BS4962:1989 and the geotextile shall be non-woven and meet the requirements of the Manual of Contract Documents for Highway Works.

Ridgidrain (Type 9)

The geotextile shall have a current British Board of Agrément Roads and Bridges certificate and be installed in accordance with the Manual of Contract Documents for Highway Works.

Note

For updated model specifications please visit our website: www.polypipecivils.co.uk

RIDGISEWER and POLYSEWER

The full Ridgisewer and Polysewer range runs from page 24 - 41

Ridgisewer & Polysewer is Polypipe's innovative system for adoptable surface, foul and combined sewers. Ridgisewer & Polysewer meet all of the demanding requirements of WIS 4-35-01, the new water industry specification for sewer pipes, including new tests for resistance to maintenance operations.

Ridgisewer & Polysewer offer benefits including

- Full compliance with WIS 4-35-01
- Reduced health and safety risks in handling, storage and installation with a weight approximately 6% of equivalent sizes of concrete pipe
- Resistance to high pressure water jetting in accordance with the WRc code of practice
- Longer lengths and with integral sockets for reduced jointing operations
- Jointing systems that remain intact even under extreme site conditions
- Inbuilt robustness for installation and maintenance operations
- Flexible construction to resist differential settlement
- Superior chemical, impact and abrasion resistance
- Immunity from sulphate attack or corrosion due to sewer gases
- Durable long-life material

Integrally socketed pipes from 150 - 900mm

Ridgisewer and Polysewer... first to be certified to WIS 4-35-01

Polypipe Civils was a key player in the industry-wide project to achieve a generic specification for structured wall sewer pipe systems. Polypipe continues to lead the way, with Ridgisewer and Polysewer the first systems to achieve prestigious British Standards Institution kitemark status.

WIS 4-35-01 is the UK specification for thermoplastic structured wall pipes for gravity sewer applications. The specification, developed by Water UK in conjunction with participating members of the British Plastics Federation, British Standards Institution, British Board of Agrément and the Water Research Centre, follows extensive research and investigation and sets out a comprehensive range of performance based tests including

- Long-term structural performance
- Joint integrity under extreme conditions
- Resistance to the effects of routine maintenance operations, including internal impact and high pressure water jetting
- External impact
- Material tests to ensure long-term durability

WIS 4-35-01 replaces all existing certifications for structured wall plastic sewer pipes.

Certificate No. KM55702 & KM 55698

400 - 900mm

150 - 300mm

Note: BBA certificates cover Ridgisewer and Polysewer pipes and fittings excluding couplers.

Ridgisewer and Polysewer... the most versatile system in the market

Ridgisewer and Polysewer are the largest structured wall range in the industry (featuring sizes from 150 to 900mm). Polysewer pipes are manufactured in uPVC in diameters from 150 to 300mm. uPVC is the most commonly used material for both single wall and structured wall pipes in diameters up to 300mm.

Ridgisewer pipes are manufactured in high stiffness polypropylene in sizes 400 to 900mm, offering stiffness well in excess of other plastic products combined with exceptional durability.

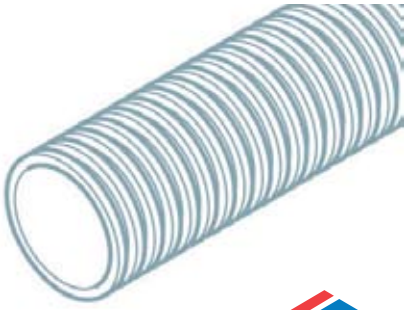
The ranges include complete systems of couplings, seals, bends junctions and specialist fabrications. The ease with which these products can be cut and welded allows them to be used to manufacture a vast range of standard and made to measure fittings, manholes, catchpits and soakaways.

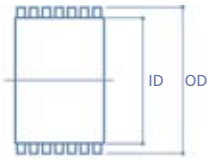
Applications

Ridgisewer and Polysewer are suitable for gravity flow foul, surface water and combined sewers. Applications include private sewers, capital projects and systems installed by developers and subsequently adopted by a statutory authority. Sewer adoption is the process whereby responsibility for the maintenance and operation of sewers constructed by Developers is transferred to a Sewerage Undertaker or Sewerage Agent Council. Within England, Wales and Northern Ireland such adoption is carried out under Section 104 of The Water Industry Act 1991. It should be noted that adoptions of surface water sewers may also take place under the Highways Act 1980 and the Ridgidrain range is normally specified for these applications. Polypipe is actively seeking formal approval for Ridgisewer and Polysewer from all UK Water Companies. For up to the minute advice contact our Technical Department or visit our website.

Plain ended pipes

NOMINAL SIZE	CODE	ID mm	OD mm	LENGTH m	WEIGHT kg/m
150	PS630	146	160	3	1.7
225	PS1030	229	250	3	3.8
300	PS1230	301	330	3	6.3
150	PS660	146	160	6	1.7
225	PS1060	229	250	6	3.8
300	PS1260	301	330	6	6.3



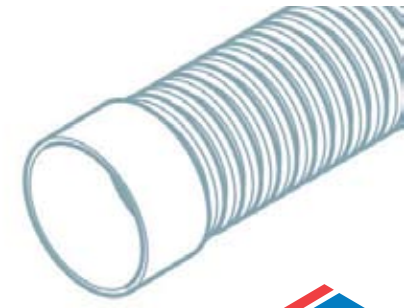


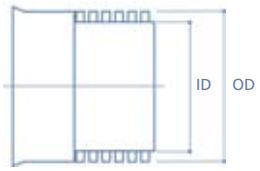
BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 02/3923

KM55698

Integrally socketed pipes

NOMINAL SIZE	CODE	ID mm	OD mm	LENGTH m	WEIGHT kg/m
150	PS632	146	160	3	1.7
225	PS1032	229	250	3	3.8
300	PS1232	301	330	3	6.3
150	PS662	146	160	6	1.7
225	PS1062	229	250	6	3.8
300	PS1262	301	330	6	6.3





BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 02/3923

KM55698

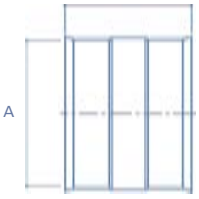
Double socket couplings

NOMINAL SIZE	CODE	A	B
150	PS601	150	183
225	PS1001	225	260
300	PS1201	300	280

All dimensions in mm

BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 02/3923

KM55698

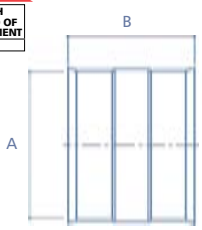


Double socket slip couplings

NOMINAL SIZE	CODE	A	B
150	PS600	150	183
225	PS1000	225	260
300	PS1200	300	280

All dimensions in mm

BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 02/3923



Sealing rings

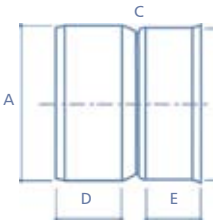
NOMINAL SIZE	CODE
150	PSSP1
225	PSSP2
300	PSSP3

Spigot adaptors to EN1401-1

NOMINAL SIZE	CODE	A	B	C	D	E
225	PS10102	250	225	241	134	92.5
300	PS12102	315	300	265	144	114

All dimensions in mm

Each adaptor is supplied with one seal

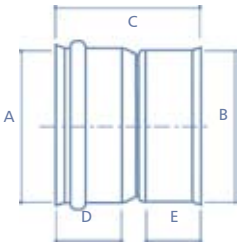


Socket adaptors to EN1401-1

NOMINAL SIZE	CODE	A	B	C	D	E
150	PS689	160	150	147	70	77
225	PS1089	250	225	240	110	92.5
300	PS1289	315	300	286	125	114

All dimensions in mm

Each adaptor is supplied with two seals

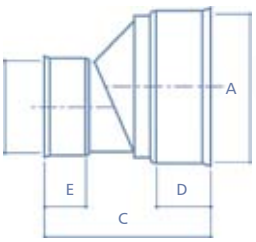


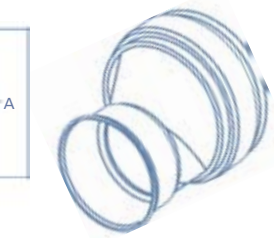
Level invert reducers

NOMINAL SIZE	CODE	A	B	C	D	E
225x150	PS1021	225	150	287	92.5	72.5
300x225	PS1221	300	220	345	114	92.5

All dimensions in mm

Each reducer is supplied with two seals



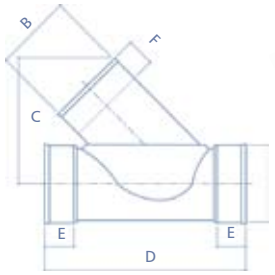


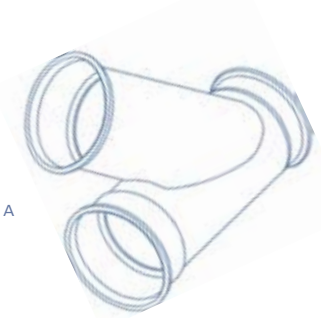
45° equal junctions

CODE	A	B	C	D	E	F
PS605	150	150	285	445	95	95
PS1005	225	225	408	647	92.5	92.5
PS1205	300	300	508	812	114	114

All dimensions in mm

Each junction is supplied with three seals



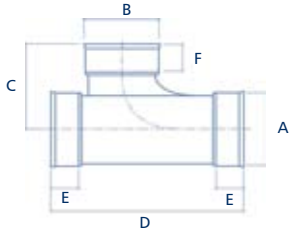


90° equal junctions

CODE	A	B	C	D	E	F
PS623	150	150	186	400	69	69

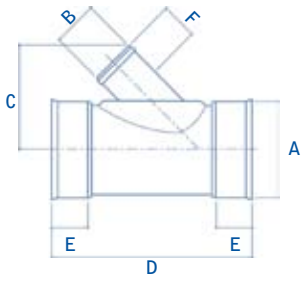
All dimensions in mm

Each junction is supplied with three seals



45° unequal junctions

CODE	A	B	C	D	E	F
PS635RS	150	110	242.5	400	62	57
PS1035RS	225	110	280.5	517	92.5	67.5
PS1031	225	150	324	537	92.5	82.5
PS1031RS	225	160	328	567	92.5	82.5
PS1235RS	300	110	311	523	114	67.5
PS1231	300	150	348	586	114	82.5
P21231RS	300	160	356	573	114	82.5
PS12100	300	225	458	704	114	100

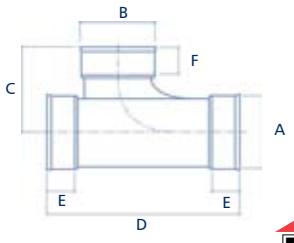


All dimensions in mm

Each junction is supplied with three seals

90° unequal junctions

CODE	A	B	C	D	E	F
PS643RS	150	110	182	301	69	65

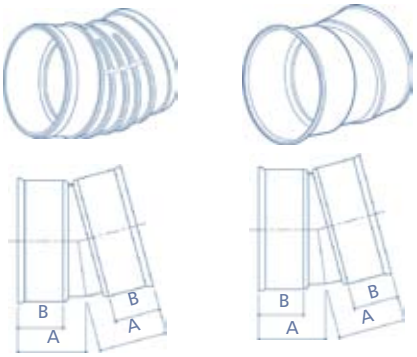


All dimensions in mm

Each junction is supplied with three seals

15° bends

NOMINAL SIZE	CODE	A	B
150	PS609	115	95
225	PS1009	123.5	92.5
300	PS1209	152	114

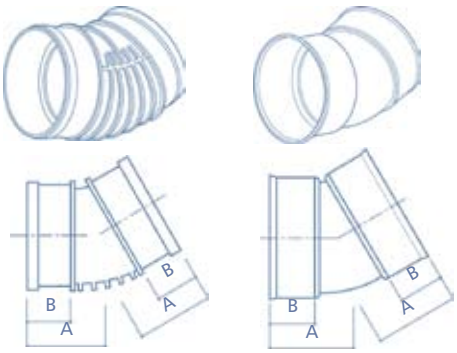


All dimensions in mm

Each bend is supplied with two seals

30° bends

NOMINAL SIZE	CODE	A	B
150	PS667	115	95
225	PS1067	143.5	92.5
300	PS1267	177	114



All dimensions in mm

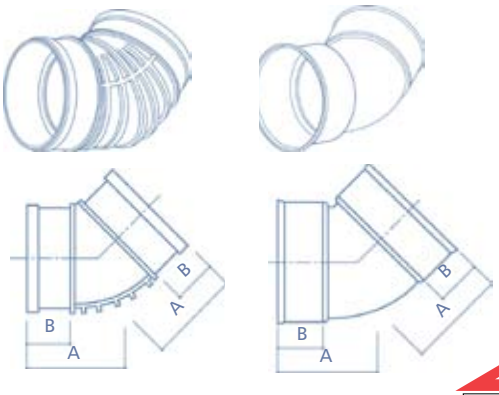
Each bend is supplied with two seals

45° bends

NOMINAL SIZE	CODE	A	B
150	PS603	135	95
225	PS1003	164.5	92.5
300	PS1203	203	114

All dimensions in mm

Each bend is supplied with two seals

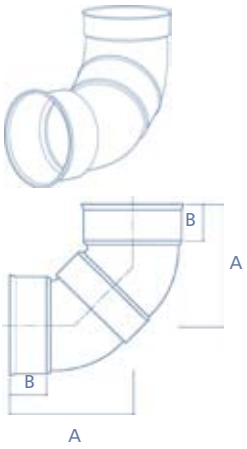


90° bends

NOM SIZE	CODE	A	B
150	PS611	190	63
225	PS1011	316.5	92.5
300	PS1211	385	114

All dimensions in mm

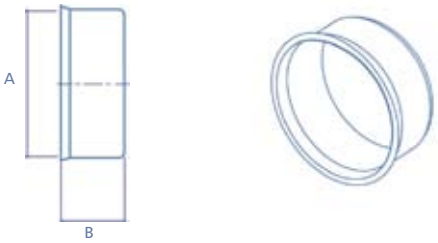
Each bend is supplied with two seals



End caps

NOMINAL SIZE	CODE	A	B
150	PS6101	150	150
225	PS10101	225	98
300	PS12101	300	121

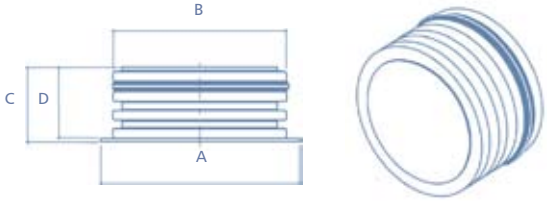
All dimensions in mm



Socket plugs

NOMINAL SIZE	CODE	A	B	C	D
150	PS620	215	178	85	76
225	PS1020	308	248	101	92
300	PS1220	395	329	110	101

All dimensions in mm

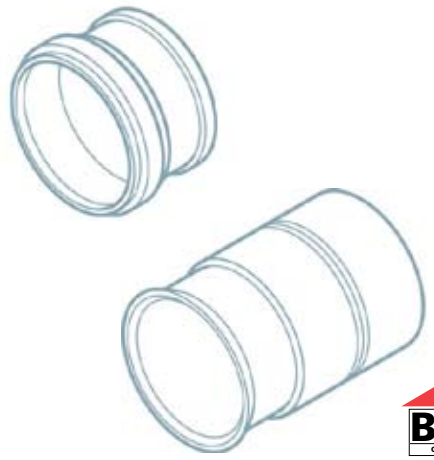


Adaptors to other pipe systems

NOMINAL SIZE	CODE	DESCRIPTION
150	PS634	Double socket to super clayware pipe
150	PS696	Double socket to thick clayware pipe
150	PS6105	Double socket to Ultrarib adapter
225	PS10105	Double socket to Ultrarib adapter
300	PS12105	Double socket to Ultrarib adapter

Each adaptor is supplied with two seals.

For adaption to 225mm and 30mm clay pipe, flexible couplings to WIS 4-41-01 should be used.

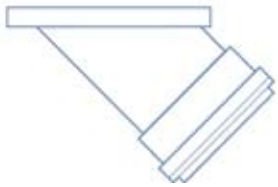


Snap cap & seals

NOMINAL SIZE	CODE	DESCRIPTION
150	PS6103	To adapt 87.5° bends and 45° unequal junctions to EN1401 pipes
150	PS6104	To adapt 87.5° junctions to EN1401 pipes

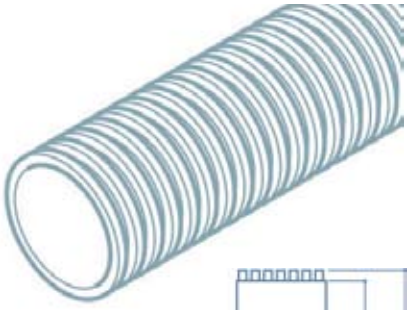
Rodding eye

NOMINAL SIZE	CODE	DESCRIPTION
150	PS6225	Sealed oval top in aluminium



Plain ended pipes

NOMINAL SIZE	CODE	ID mm	OD mm	LENGTH m	WEIGHT kg/m
400	RSW400X6PE4	400	457	6	9.4
450	RSW450X6PE4	450	511	6	11.8
500	RSW500X6PE4	500	568	6	13.3
600	RSW600X6PE4	587	672	6	15.3
400	RSW400X3PE4	400	457	3	9.4
450	RSW450X3PE4	450	511	3	11.8
500	RSW500X3PE4	500	568	3	13.3
600	RSW600X3PE4	587	672	3	15.3



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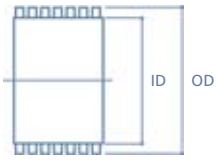
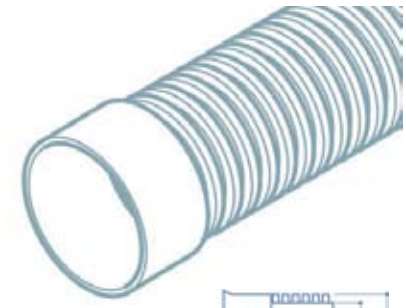


Integrally socketed pipes

NOMINAL SIZE	CODE	ID mm	OD mm	LENGTH m	WEIGHT kg/m
400	RSW400X6IS4	400	457	6	9.4
450	RSW450X6IS4	450	511	6	11.8
500	RSW500X6IS4	500	568	6	13.3
600	RSW600X6IS4	587	672	6	15.3
400	RSW400X3IS4	400	457	3	9.4
450	RSW450X3IS4	450	511	3	11.8
500	RSW500X3IS4	500	568	3	13.3
600	RSW600X3IS4	587	672	3	15.3
750	RSW750X3IS4	765	880	3	35
900	RSW900X3IS4	909	1032	3	38



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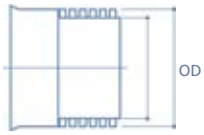
BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 03/3979



Double socket couplings

NOMINAL SIZE	CODE	A	B
400	RSWC400	410	490
450	RSWC450	440	548
500	RSWC500	490	605
600	RSWC600	560	713

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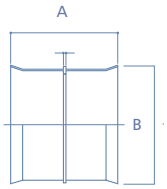


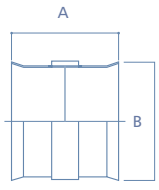
All dimensions in mm

Double socket slip couplings

NOMINAL SIZE	CODE	A	B
400	RSWSC400	392	490
450	RSWSC450	420	548
500	RSWSC500	470	605
600	RSWSC600	540	713

BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 03/3979

KM55701



All dimensions in mm

Sealing rings

NOMINAL SIZE	CODE
400	SRDS400
450	SRDS450
500	SRDS500
600	SRDS600
750	SRDS750
900	SRDS900

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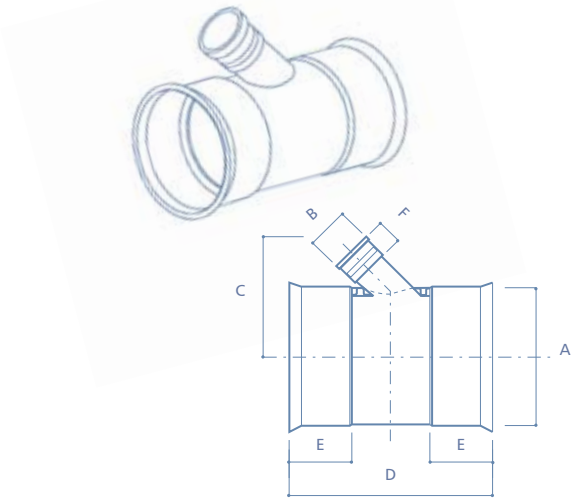
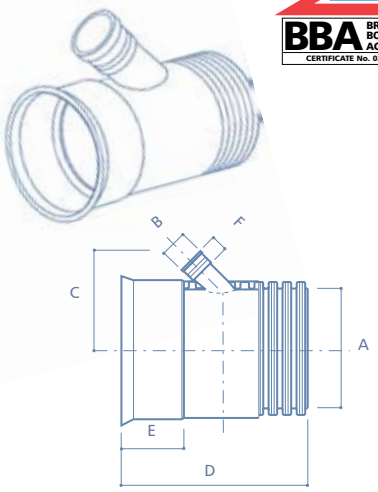
KM55701

45° unequal junctions

A	B	CODE	C	D	E	F
400	110	RSWJ400110Y	395	750	196	46
400	160	RSWJ400160Y	435	750	196	51
450	110	RSWJ450110Y	422	815	215	46
450	160	RSWJ450160Y	462	815	215	51
500	110	RSWJ500110Y	450	920	240	46
500	160	RSWJ500160Y	490	920	240	51
600	110	RSWJ600110Y	503	1060	275	46
600	160	RSWJ600160Y	543	1060	275	51
750	110	RSWJ750110Y*	545	1330	440	46
750	160	RSWJ750160Y*	584	1330	440	51
900	110	RSWJ900110Y*	629	1332	440	46
900	160	RSWJ900160Y*	668	1332	440	51



A	B	Code	C	D	E	F
400	150	RSWPSJ400150Y	435	750	196	51
450	150	RSWPSJ450150Y	462	815	215	51
500	150	RSWPSJ500150Y	490	920	240	51
600	150	RSWPSJ600150Y	543	1060	275	51
750	150	RSWPSJ750150Y*	584	1330	440	51
900	150	RSWPSJ900150Y*	668	1332	440	51



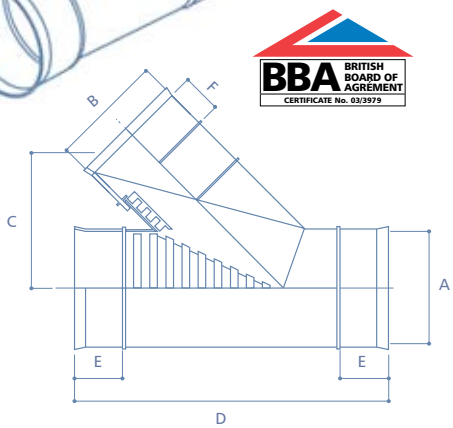
- 110 & 160mm branches are for EN1401 pipes
- 150mm branches are for Polysewer

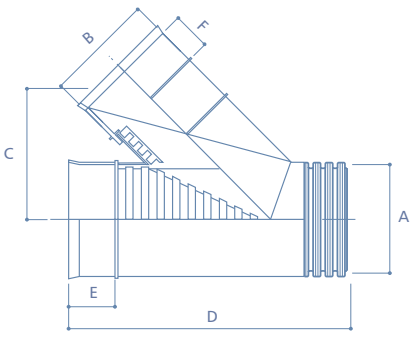
All dimensions in mm
Order seals seperately
*These junctions are made to order and are subject to lead times.

45° equal junctions

A	B	CODE	C	D	E	F
400	400	RSWEJ400Y	1000	1737	205	205
450	450	RSWEJ450Y	1050	1780	220	220
500	500	RSWEJ500Y	1100	1930	245	245
600	600	RSWEJ600Y	1309	2175	280	280
750	750	RSWEJ750Y*	1000	2100	440	440
900	900	RSWEJ900Y*	820	2300	440	440

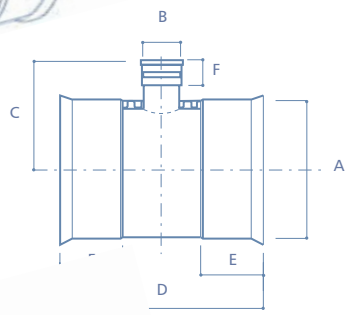
All dimensions in mm
*These junctions are made to order and are subject to lead times.



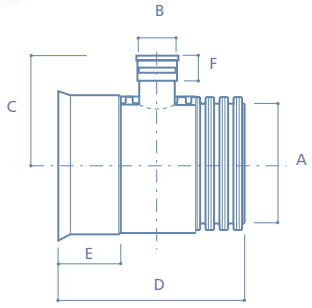


90° unequal junctions

A	B	CODE	C	D	E	F
400	110	RSWJ400110T	360	750	196	46
400	160	RSWJ400160T	375	750	196	51
450	110	RSWJ450110T	385	815	215	46
450	160	RSWJ450160T	400	815	215	51
500	110	RSWJ500110T	415	920	240	46
500	160	RSWJ500160T	430	920	240	51
600	110	RSWJ600110T	465	1060	275	46
600	160	RSWJ600160T	480	1060	275	51
750	110	RSWJ750110T*	563	1330	440	46
750	160	RSWJ750160T*	581	1330	440	51
900	110	RSWJ900110T*	639	1332	440	46
900	160	RSWJ900160T*	657	1332	440	51



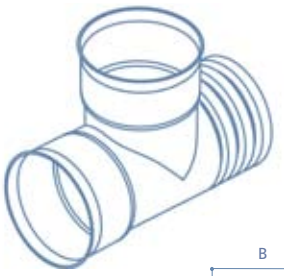
A	B	CODE	C	D	E	F
400	150	RSWPSJ400150T	375	750	196	51
450	150	RSWPSJ450150T	400	815	215	51
500	150	RSWPSJ500150T	430	920	240	51
600	150	RSWPSJ600150T	480	1060	275	51
750	150	RSWPSJ750150T*	581	1330	440	51
900	150	RSWPSJ900150T*	657	1332	440	51

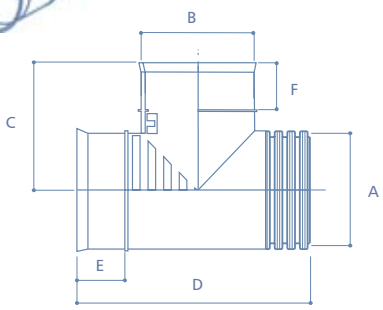


• 110 & 160mm branches are for EN1401 pipes • 150mm branches are for Polysewer
All dimensions in mm
Order seals seperately
*These junctions are made to order and are subject to lead times.

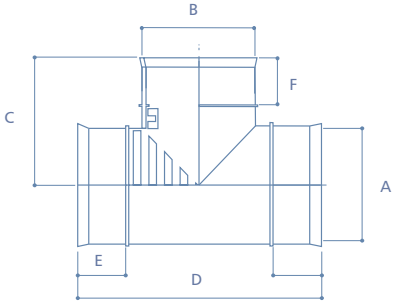
90° equal junctions

A	B	CODE	C	D	E	F
400	400	RSWEJ400T	700	1380	205	205
450	450	RSWEJ450T	850	1792	245	245
500	500	RSWEJ500T	850	1792	245	245
600	600	RSWEJ600T	1350	1975	280	280
750	750	RSWEJ750T*	1000	1700	440	440
900	900	RSWEJ900T*	1200	1900	440	440



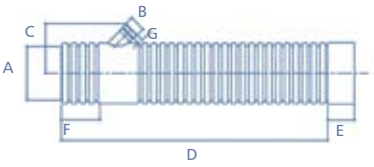


All dimensions in mm
*These junctions are made to order and are subject to lead times.



3m junction (single) - made to order

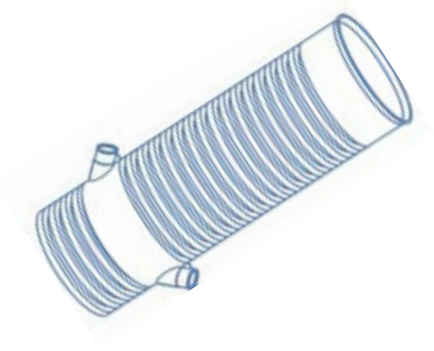
A	B	CODE	C	D	E	F	G
400	160	RSWJ400160Yx3S	440	3000	205	230	50
450	160	RSWJ450160Yx3S	467	3000	220	250	50
500	160	RSWJ500160Yx3S	496	3000	245	280	50
600	160	RSWJ600160Yx3S	548	3000	280	325	50
750	160	RSWJ750160Yx3S	652	3000	440	450	50
900	160	RSWJ900160Yx3S	728	3000	440	435	50
400	150	RSWPSJ400150Yx3S	440	3000	205	230	50
450	150	RSWPSJ450150Yx3S	467	3000	220	250	50
500	150	RSWPSJ500150Yx3S	496	3000	245	280	50
600	150	RSWPSJ600150Yx3S	548	3000	280	325	50
750	150	RSWPSJ750150Yx3S	652	3000	440	450	50
900	150	RSWPSJ900150Yx3S	728	3000	440	435	50

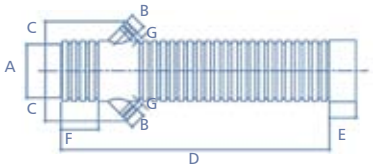


• 160mm branches are for EN1401 pipes • 150mm branches are for Polysewer
All dimensions in mm
Order seals seperately if required

3m junction (double) - made to order

A	B	CODE	C	D	E	F	G
400	160	RSWJ400160Yx3D	440	3000	205	230	50
450	160	RSWJ450160Yx3D	467	3000	220	250	50
500	160	RSWJ500160Yx3D	496	3000	245	280	50
600	160	RSWJ600160Yx3D	548	3000	280	325	50
750	160	RSWJ750160Yx3D	652	3000	440	450	50
900	160	RSWJ900160Yx3D	728	3000	440	435	50
400	150	RSWPSJ400150Yx3D	440	3000	205	230	50
450	150	RSWPSJ450150Yx3D	467	3000	220	250	50
500	150	RSWPSJ500150Yx3D	496	3000	245	280	50
600	150	RSWPSJ600150Yx3D	548	3000	280	325	50
750	150	RSWPSJ750150Yx3D	652	3000	440	450	50
900	150	RSWPSJ900150Yx3D	728	3000	440	435	50





• 160mm branches are for EN1401 pipes • 150mm branches are for Polysewer
All dimensions in mm
Order seals seperately if required

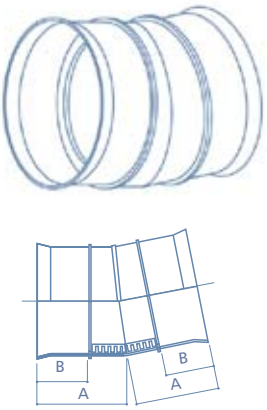
11.25° bends

	NOMINAL SIZE	CODE	A	B
TYPE 1	400	RSWB40011.25	375	205
	450	RSWB45011.25	415	220
	500	RSWB50011.25	490	245
	600	RSWB60011.25	535	280
TYPE 2	*750	RSWB75011.25	600	440
	*900	RSWB90011.25	800	440

All dimensions in mm
*These bands are made to order and are subject to lead times

BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 03/3979

TYPE 1



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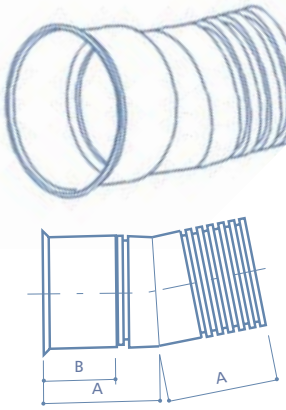


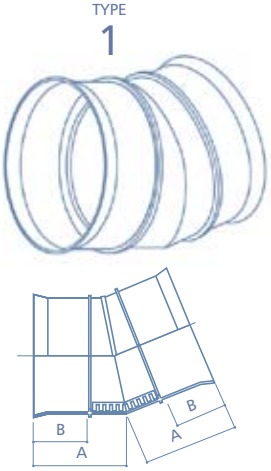
22.2° bends

	NOMINAL SIZE	CODE	A	B
TYPE 1	400	RSWB40022.5	375	205
	450	RSWB45022.5	415	220
	500	RSWB50022.5	490	245
	600	RSWB60022.5	535	280
TYPE 2	*750	RSWB75022.5	700	440
	*900	RSWB90022.5	900	440

All dimensions in mm
*These bands are made to order and are subject to lead times

BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 03/3979

TYPE 1



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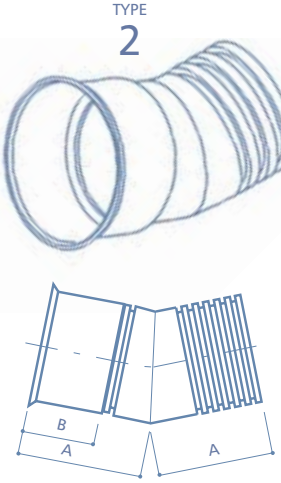


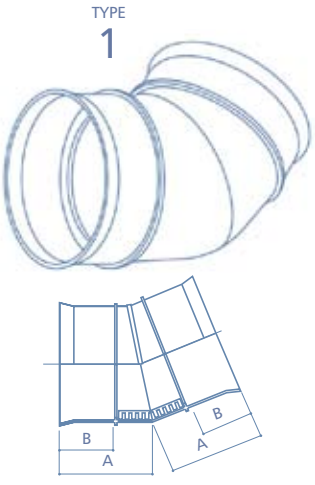
45° bends

	NOMINAL SIZE	CODE	A	B
TYPE 1	400	RSWB40045	375	205
	450	RSWB45045	415	220
	500	RSWB50045	490	245
	600	RSWB60045	535	280
TYPE 2	*750	RSWB75045	800	440
	*900	RSWB90045	1000	440

All dimensions in mm
*These bands are made to order and are subject to lead times

BBA BRITISH BOARD OF AGRÉMENT CERTIFICATE No. 03/3979

TYPE 1



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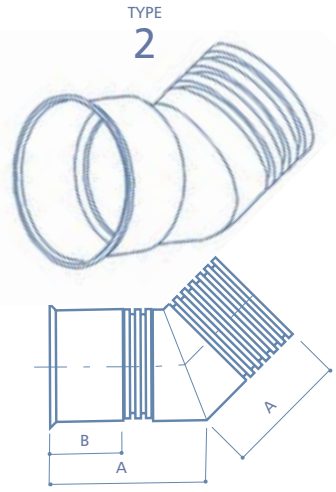
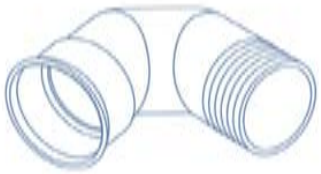
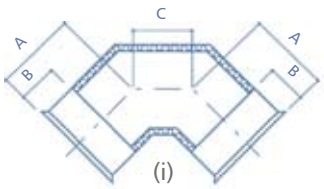


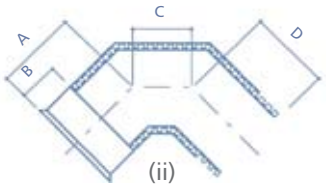
90° bends

NOMINAL SIZE	CODE	A	B	C	D
400	RSWB40090	411	196	646	Spigot
450	RSWB45090	441	215	667	Spigot
500	RSWB50090	488	250	687	Spigot
600	RSWB60090	533	275	728	Spigot
750*	RSWB75090	738	440	818	658
900*	RSWB90090	770	440	882	690

All dimensions in mm
These bends are made to order and subject to lead times







End caps

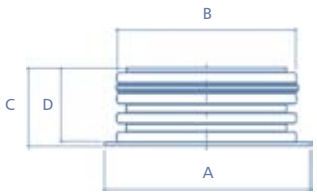
NOMINAL SIZE	CODE
400	RSWEC400
450	RSWEC450
500	RSWEC500
600	RSWEC600
750	RSWEC750
900	RSWEC900

All dimensions in mm

Socket plugs

NOMINAL SIZE	CODE	A	B	C	D
400	RSWSP400	520	457	204	195
450	RSWSP450	578	511	188	197
500	RSWSP500	635	568	225	216
600	RSWSP600	741	672	261	252
750	RSWSP750	979	880	395	386
900	RSWSP900	1136	1032	399	390

All dimensions in mm



Rocker pipes

NOMINAL SIZE	CODE	ID	OD	LENGTH (m)
750	RSWRP750	765	880	1
900	RSWRP900	909	1032	1

KM55701

Order seals seperately

Stub pipes

NOMINAL SIZE	CODE	ID	OD	LENGTH (m)
750	RSWST750	765	880	1
900	RSWST900	909	1032	1

KM55701

Order seals seperately

Ridgitite saddles

CARRIER PIPE DIAMETER	CODE	PIPE CLASSIFICATION	CORRUGATION HEIGHT
300	SLDPS300	Polysewer	15-18
400/450	SLD375450	Ridgisewer	29-33
500	SLD500	Ridgisewer	35-38
600	SLD600	Ridgisewer	41-44
177	HOL177	Hole saw	

WRC Approved
PT/193/1102

Ridgisewer Pipe Specification 2.3

WIS 4-35-01 is the UK specification for thermoplastic structured wall pipes for gravity sewer applications. Developed by Water UK, in conjunction with participating members of the British Plastics Federation, British Standards Institution, British Board of Agrèment and Water Research Centre; following extensive research and investigation.

It sets out a comprehensive range of performance based tests, summarised in the table below:

PROPERTY	STANDARD
Ring flexibility	BS EN 1446
Short term ring stiffness	BS EN ISO 9969
Long term ring stiffness (Creep ratio)	BS EN ISO 9967
Impact resistance	BS EN 1411
Leaktightness of seals - Distortion	BS EN ISO 1277
Leaktightness of seals - Deflection	BS EN ISO 1277
Long term strength and heat resistance (Box Load Test)	BS EN 1437 (150 - 375mm ø only)
Internal puncture	WIS 4-35-01, Appendix B
Water Jetting	WIS 4-35-01, Appendix C
Longitudinal bending	WIS 4-35-01, Appendix D
Heat test	BS EN 742
Stress relief of injection moulded Couplers	BS 2782

Refer to WIS 4-35-01 for specific details of individual tests

Stiffness Classification

Ridgisewer pipes are offered in stiffness class SN4 as standard.
In accordance with WIS 4-35-01 pipes may be manufactured in two stiffness classifications. In order to satisfy the relevant stiffness classification, when tested in accordance with BS EN ISO 9969:1995, the pipe must have a nominal short term ring stiffness not less than either:

- The stated nominal short term ring stiffness (WIS 4-35-01, Table 6), or
- The stated creep ratio (WIS 4-35-01, Table 3) multiplied by a stated 2 year stiffness (WIS 4-35-01, Table 3).

Consequently, in order to comply with WIS 4-35-01, Class SN4 Ridgisewer does in fact have a short term ring stiffness no less than 8 kN/m^2

A comparison may be drawn with flexible highway drainage systems which are required to have a short term ring stiffness of 6kn/m^2

In addition to being manufactured under a BS EN ISO 9001:2000 quality management system, Ridgisewer has undergone extensive testing by independent third parties, resulting in the following certification:

- BSI Kite Mark Certificate No KM55701
- BBA Certificate No 03/3979

Deformation Figures

Table 2.4.1 Short-term pipe design properties

NOMINAL SIZE (mm)	MEAN DIAMETER (m)	I ($m^4/m \times 10^{-9}$)	E ($kN/m^2 \times 10^3$)	EI/D^3 (kN/m^2)
Polysewer				
150	0.151	18.2	2800	14.65
225	0.237	55.1	2800	11.52
300	0.311	110.0	2800	10.19
Ridgisewer				
400	0.422	604.7	1500	12.06
450	0.474	760.0	1500	10.65
500	0.527	972.9	1500	9.96
600	0.619	1375.9	1500	8.70
750	0.808	4071.0	1500	11.58
900	0.952	4081.0	1500	7.09

Table 2.4.2 Long-term pipe design properties

NOMINAL SIZE (mm)	MEAN DIAMETER (m)	I ($m^4/m \times 10^{-9}$)	E ($kN/m^2 \times 10^3$)	EI/D^3 (kN/m^2)
Polysewer				
150	0.151	18.2	500	2.62
225	0.237	55.1	500	2.06
300	0.311	110.0	500	1.82
Ridgisewer				
400	0.422	604.7	300	2.41
450	0.474	760.0	300	2.13
500	0.527	972.9	300	1.99
600	0.619	1375.9	300	1.74
750	0.808	4071.0	300	2.32
900	0.952	4081.0	300	1.42

Flotation

Although unlikely to occur, the potential for flotation should be checked in installations where the water table is above the pipe invert level. Table 3.3 details uplift forces for the following conditions:

Pipe bore empty

This is applicable to empty carrier drainage systems. The uplift forces are due to air trapped within the corrugations and the pipe bore.

Pipe bore full

This is applicable to filter drainage pipes and filled carrier drainage pipes. The uplift forces are due to air trapped within the corrugations.

Table 3.3 Uplift forces for fully submerged pipes

DIAMETER (mm)	Flotation Force Pipe Bore Full (kN/m)	Flotation Force Pipe Bore Empty (kN/m)
Polysewer		
150	0.006	0.170
225	0.013	0.417
300	0.036	0.734
Ridgisewer		
400	0.190	1.422
450	0.244	1.804
500	0.314	2.240
600	0.443	3.098
750	0.734	5.243
900	0.867	7.233

N.B. Fluid Density of 1000kg/m^3 assumed

The difference in flotation forces between Ridgsewer SN4 and SN8 pipes is negligible. The worst case figure is used. An appropriate factor of safety should be used to ensure prevention of flotation after installation. Please note that Ridgisewer and Polysewers pipes may float if a substantial depth of water is in the trench during installation.

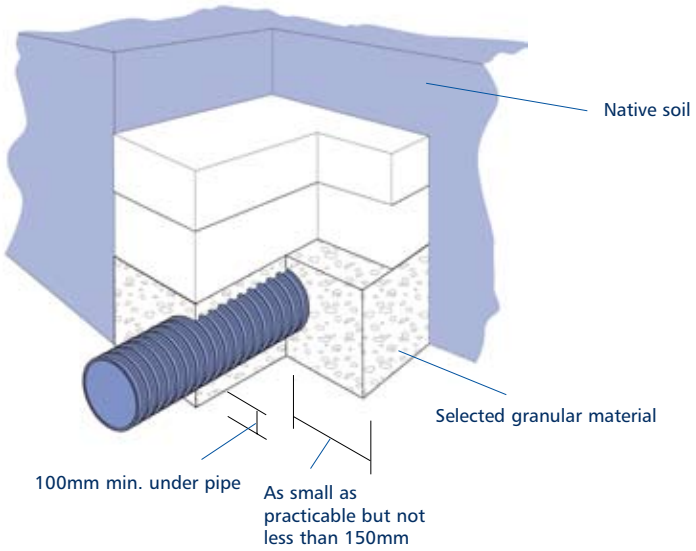
Structural properties.

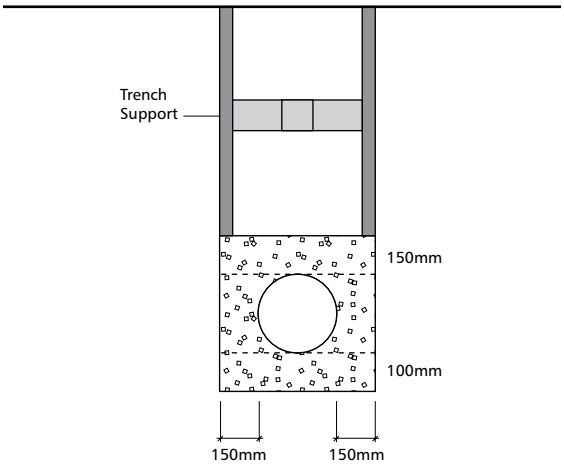
Where a detailed structural design check is required, values from tables 2.4.1 & 2.4.2 may be used for design purposes.
Please refer to Section 3.2 for structural design methodology of flexible pipe systems.

Installation

Installation of the Polysewer / Ridgisewer system is typically carried out in accordance with Sewers for Adoption 6th Edition. Sewerage undertakers approving Polysewer / Ridgisewer have adopted the following installation detail.

Granular Bed & Surround





Extract from Table A2 WIS 4-08-02

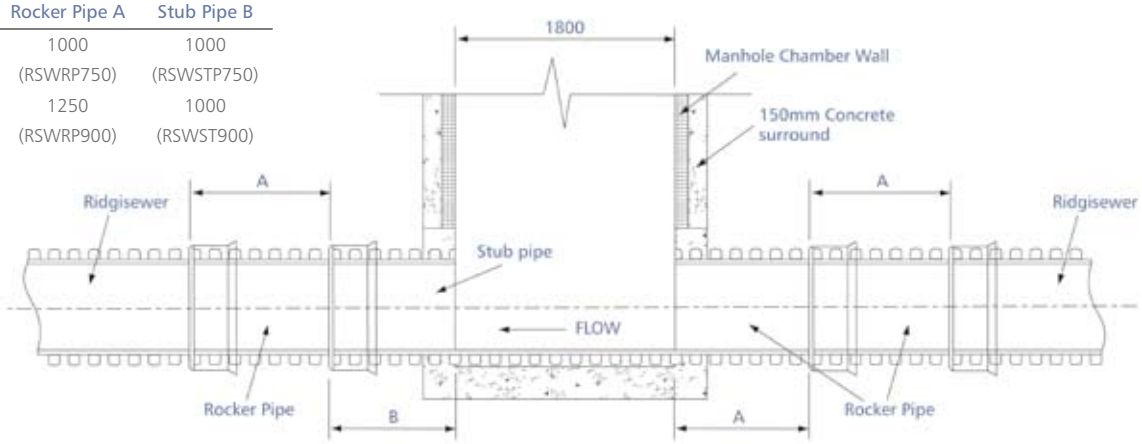
PIPE NOMINAL BORE (MM) (mm) see note (4)	NOMINAL MAXIMUM PARTICLE SIZE (mm)	MATERIALS SPECIFIED IN BRITISH STANDARDS, SEE NOTE (2)
100	10	10mm nominal single-size
Over 100 to 500	15	10 or 14mm nominal single-size or 14mm to 5mm graded
Over 150 to 300	20	10, 14 or 20mm nominal single-size or 14mm to 5mm graded or 20mm to 5mm graded
Over 300 to 550	20	14 or 20mm nominal single-size or 14mm to 5mm graded or 20mm to 5mm graded
Over 550	40	14, 20 or 40mm nominal single-size or 14mm to 5mm graded or 20mm to 5mm graded or 40mm to 5mm graded

Notes

1. Nominal bore is used in preference to DN because of the different nominal size classifications for flexible pipes
2. Processed granular materials to include aggregates to BS 882, air-cooled blast furnace slag to BS 1047 and lightweight aggregates to BS 3797
3. All temporary and enabling works are by others
4. Nominal bore is used in the preference to DN because of the different nominal size classifications for flexible pipes
5. The constructor should check with the adopting authority for local variations to this detail
6. This document is uncontrolled and updates will not be issued automatically

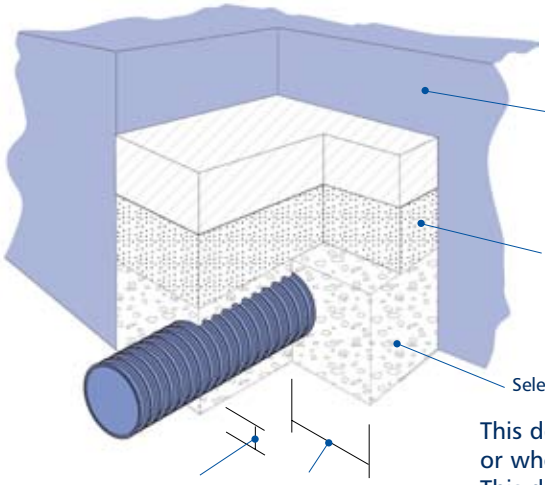
Rocker Pipe Detail

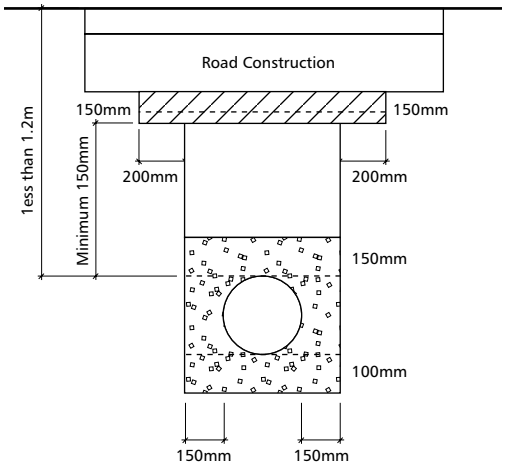
	Rocker Pipe A	Stub Pipe B
750mm Ridgisewer (Product Code)	1000 (RSWRP750)	1000 (RSWSTP750)
900mm Ridgisewer (Product Code)	1250 (RSWRP900)	1000 (RSWST900)



Where the minimum depth of cover can not be acheived, protective measures should be undertaken. This may take the form of one of the following. However, it should be noted that Sewer undertakers may have a particular protection method preference.

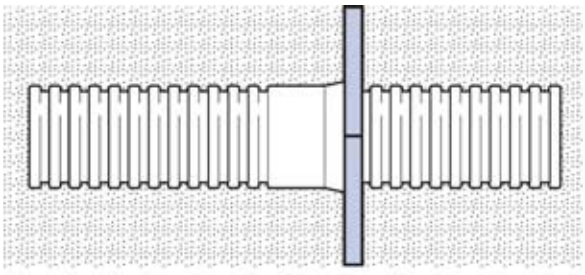
Concrete Protection Slab

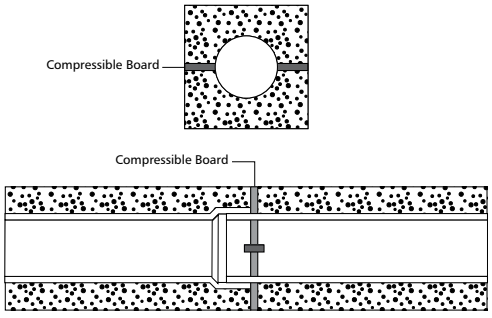

Native soil
Reinforced concrete slab (may be precast) extending to trench walls and sufficiently strong to span across.
Selected granular material
100mm min. under pipe
As small as practicable but not less than 150mm



This detail is recommended where depths of cover are less than recommended or where loading is excessive. (see section 3.1)
This detail is preferable to a concrete bed and surround because the flexibility of the pipe system is maintained.

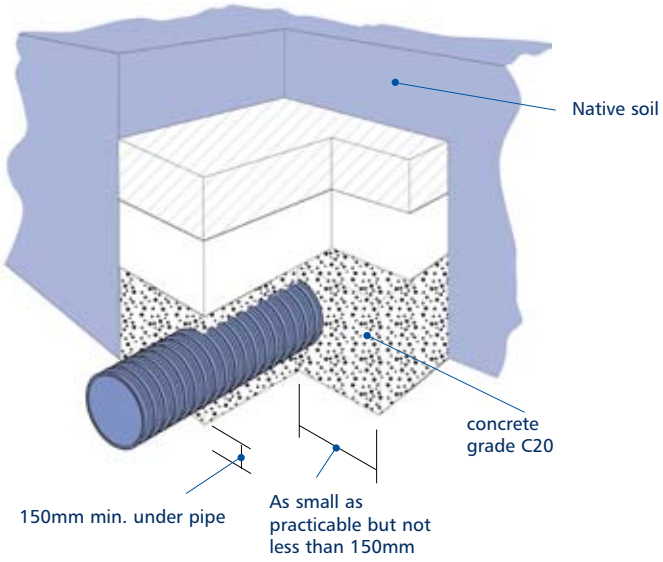
Flexible Joint in Concrete Bed and Surround

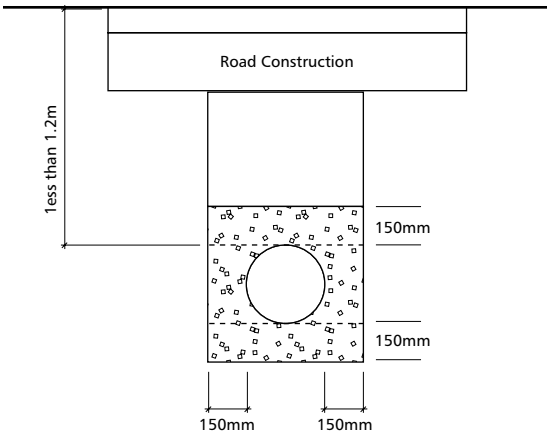




Joint filler board should be placed in contact with the end of the socket at a pipe joint and should extend through the full thickness of the concrete in contact with the pipe. Flexible joints shall be at intervals of 5m or at each joint, whichever is the greater.

Concrete Bed and Surround





Concrete (where necessary - e.g. pipe depth <1.2m; under roads):

- MINIMUM 150mm below pipe base (Diagram B)
- C20 grade concrete (Diagram B)
- Incorporate flexible joints through concrete surround at mouth of pipe sockets

Polysewer and Ridgisewer Gravity Sewer Pipes

For applications subject to design and installation in accordance with 'Sewers for Adoption - a design and construction guide for developers'; 6th Edition" The pipes shall be thermoplastic structured wall pipes and shall comply with the relevant provisions of WIS 4-35-01.

Polysewer and Ridgisewer Gravity Sewer Pipes

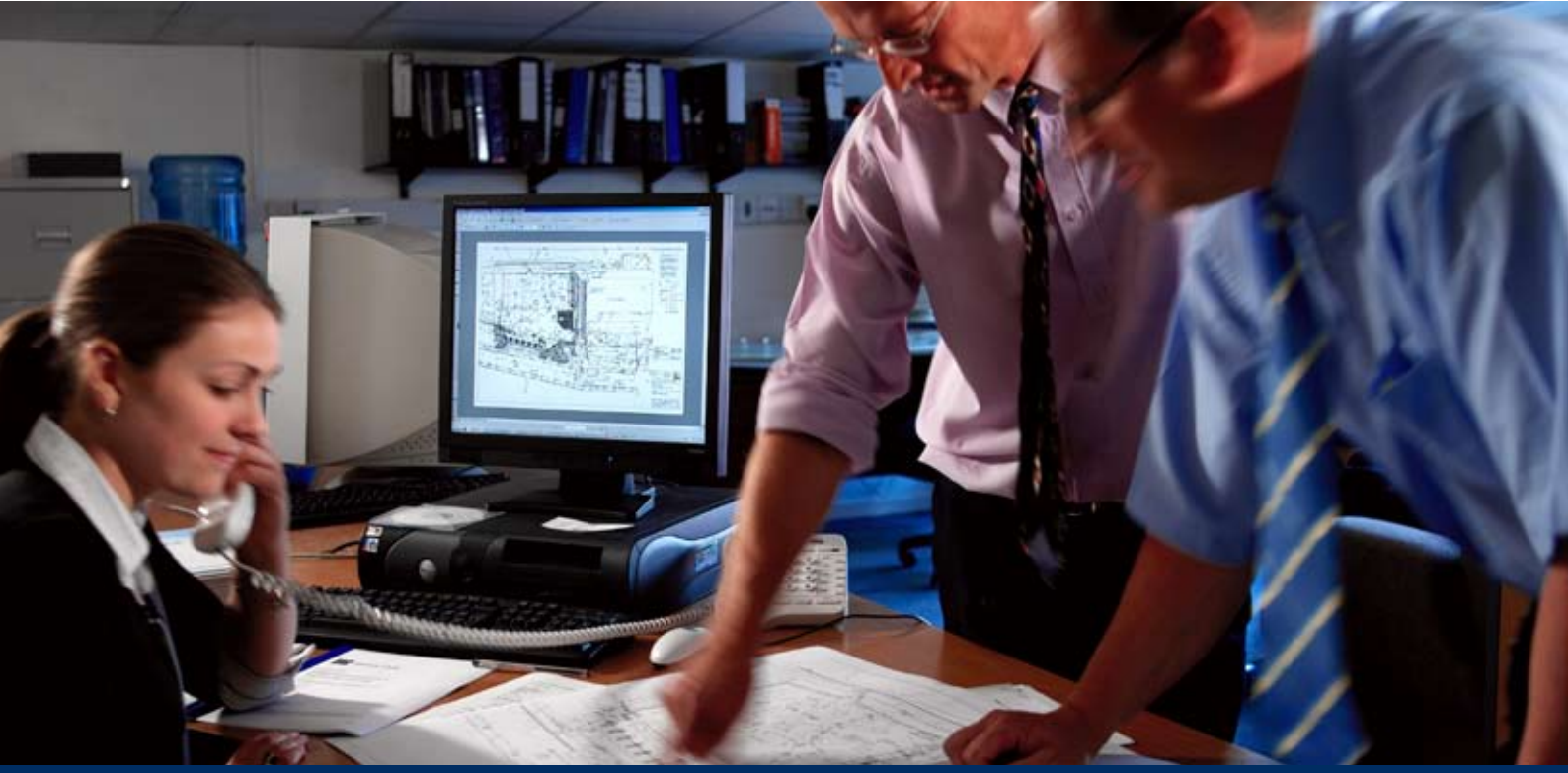
For applications subject to 'Civil engineering specification for the water industry'; 6th Edition The pipes shall be thermoplastic structured wall pipes and shall comply with the relevant provisions of WIS 4-35-01.

Ridgigully

The surface water gullies shall be single piece gullies moulded in HDPE and shall have a current British Board of Agrément Roads and Bridges certificate. The outlet shall be trapped as standard and capable of being converted to an untrapped gully by removal of the factory installed stopper. The gully shall be corrugated for enhanced stiffness and to key into the concrete surround. Gullies shall be installed in accordance with the Manual of Contract Documents for Highway Works.

KM55698

BBA BRITISH BOARD OF AGREMENT CERTIFICATE No. 02/3923



GENERAL

The proposed application dictates the choice of system from Polypipe Civils range of structured walled thermoplastic pipes.

Product	Description	Application
Ridgidrain	Surface water drainage	Road, Rail, Airports, Landfill, Sport facilities and Environmental systems
Polysewer Ridgisewer	Gravity surface water and foul sewer systems	Private & adoptable sewer systems, capital work schemes

The different water authorities have varying performance criteria. Polypipe Civils offers a suitable product to meet this criteria.

Minimum cover depths

Polypipe Civils Limited recommends the following minimum depths of cover:

- 1.2 metres from the crown of the pipe to the surface under roads subject to Highways Agency requirements
- 0.9 metres from the crown of the pipe to the surface under roads not subject to Highways Agency requirements
- 0.6 metres under field loading conditions

Reduced cover depths may be allowable, subject to specific design checks, for particular circumstances such as parking areas physically restricted to light vehicles.

However, it should be noted that the relevant adopting authority may have additional installation requirements. Sewers for Adoption 6th Edition stipulates that sewers laid within a highway maintain a minimum depth of cover of 1.2m and a depth of 0.9m in all other areas.

Maximum cover depths

The maximum allowable depth of cover will depend on:

- The stiffness of the natural soil in which the trench is cut
- The density of the overburden
- Magnitude of dynamic loads due to trafficking
- Hydrostatic loading
- Acceptable factor of safety against buckling
- The stiffness of the pipe bed and surround
- Specified maximum limit of deflection

When installed in competent ground with a compact granular bed and surround, such as a Type S to the Manual of Contract Documents for Highway Works, 6 metres can be taken as a safe depth of cover without the requirement for a further design check.

Greater depths of cover are acceptable but a specific design check would be required in accordance with section (3.2).

Pipe structural performance

Pipes are typically categorised as rigid or flexible, depending upon the material from which they are manufactured. Rigid pipes, such as concrete, have a high inherent strength and resist applied loading by a bending action within the pipe walls. They are generally stiffer than the pipe surround material, in particular the sidefill, and consequently support a higher load than the sidefill material. For design purposes, they are generally assumed to support the entire vertical load transmitted through the backfill material placed above the level of the pipe crown (Figure 1B)*.

Failure of rigid pipes occurs when the vertical loading exceeds its load capacity and causes fracture of the pipe wall (Figure 2B*). In order to perform satisfactorily the pipe must therefore be strong enough to support the design loading, in addition to being laid on a stiff bedding material, which must ultimately support the loads transmitted through the pipes. The bedding must not allow differential settlement of the pipeline to occur, since this would result in stress concentrations in the pipe wall and result in failure.

Compared with rigid pipes, flexible pipes are versatile and have important structural performance advantages. Unlike rigid pipes, flexible pipes have excellent resistance to differential settlement. Plastic pipes, when overloaded, will simply deform (Figure 2A) further to generate greater passive earth pressures until the system regains equilibrium. In contrast, overloaded rigid pipes are subject to fracture that can result in catastrophic failure of the system.

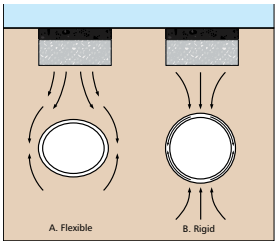


Figure 1* - Illustration of performance mechanisms

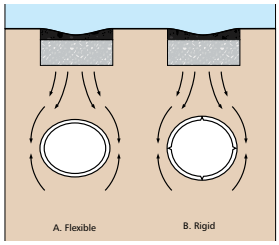


Figure 2* - Illustration of overloading effect

As a consequence of the differing performance mechanisms, flexible pipes have structural performance advantages over rigid pipe systems.

- Flexible pipes offer excellent resistance to differential settlement and ground movement.
- When overloaded, rigid pipes are subject to fracture and failure of the system. Plastic pipes, when overloaded, will deflect further to generate greater passive earth pressures until the system regains equilibrium.

Pipe deformation

The deformation of flexible pipes under load results in the ovalisation of the pipe (a reduction in the vertical diameter and an increase in the horizontal diameter). As the horizontal diameter of the pipe increases, it derives support from the sidefill and trench wall. This passive earth pressure increases as the pipe deforms further until the pipe-soil system comes into equilibrium. Further deformation will not occur thereafter unless a higher vertical load is applied to the pipe-soil system or consolidation (or creep) of the materials occurs over a long period of time. It is internationally recognised that when a pipe is installed in accordance with an appropriate code of practice, increases in deflection virtually stops after a short period of time. The duration of time is dependent on soil and installation conditions but generally does not exceed two years.

Serviceability limits

Deformation of flexible pipes must occur if the pipe-soil system is to reach equilibrium. Therefore deformation is not detrimental, but a natural action allowed for in flexible pipe design. European research on flexible pipes has shown that pipe deformations of more than 30% have occurred in practice without signs of structural failure.

However, it is accepted that a limit on vertical deformation is necessary to ensure adequate long term pipe performance. Appropriate deflection (serviceability) limits should be set on a case by case basis. For example, greater limits may be allowable in a deep landfill installation compared to a pipe buried at a shallow depth under a road.

Deflection limits within the UK varies, depending on the relevant adopting authority. For design purposes the Highways Agency specifies a maximum allowable deformation of 5% for thermoplastic structured walled pipes, while the water industry tends to specify 6%.

Methods of flexible pipe design

Numerous methods of pipeline design have been developed, influenced by the prevailing conditions in the country in which the development occurred. The most established method of design for flexible pipes is that produced by Spangler. Although originally developed for large diameter thin-walled corrugated steel culverts under embankment conditions, the method has been adopted in much of the world for all types of flexible pipes. This design method is recommended for the UK in BS EN 1295: Part 1 and forms the basis of this section.

Prediction of long term pipe deformation

BS EN 1295-1:1998; "Structural design of buried pipelines under various conditions of loading."; is the standard used within the UK in assessing pipeline design. The various different types of pipe systems available are differentiated according to cross-sectional behaviour as rigid, semi-rigid or flexible.

For design purposes, the flexible calculation procedure is normally used for pipes manufactured from steel, thermoplastic and GRP.

The following procedure is extracted from BS EN 1295-1, Clause NA.6:

Ovalization,	$\frac{\Delta}{D} = \frac{K_x [(D_L P_e) + P_s]}{(8EI/D^3) + (0.061E')}$		(Clause NA.6.2.4; BS EN 1295-1)
Where:	Δ	= Pipe deflection	
	D	= Pipe diameter	
	P_e	= Vertical Soil Pressure	
		= γH	
	P_S	= Surcharge pressure, due to vehicle wheels	(Figure NA. 6; BS EN 1295-1)
	D_L	= Deflection lag factor	
		= 1 (Non pressure application)	(Table NA. 6; BS EN 1295-1)
	K_x	= Deflection Co-efficient	
		= 0.083 (Based on a Class S1 embedment)	(Table NA. 6; BS EN 1295-1)
	EI/D^3	= Product modulus	(Polypipe Civils Technical Data)
	E'	= Overall soil modulus	

Overall Soil Modulus,	E'	= $E'_2 C_L$	
Where:	E'_2	= Bed & surround soil modulus	(Table NA. 6; BS EN 1295-1)
	C_L	= Soil modulus adjustment factor	
Soil modulus adjustment factor, C_L	$= \frac{0.985 + (0.544\ B_d/B_c)}{[1.985\text{-}0.456\ (B_d/B_c)]\ (E'_2/E'_3) - [1\text{-}(B_d/B_c)]}$		(Clause NA.6.2.4; BS EN 1295-1)
Where:	B_c	= Pipe O.D	
	B_d	= Trench width = Bc + 300mm	
	E'_3	= Native Soil Modulus	(Table NA.1; BS EN 1295-1)

Vertical soil pressure (P_e)

The vertical dead load applied to the pipe system is typically restricted to the soil pressure generated by the pipe backfill material. The load is taken as the pressure imposed by the prism of soil directly overlying the pipe. No allowance is made within the standard for the effect of shear between the backfill material and the trench walls. Where the density of the backfill material is not available, 19.6 kN/m^3 may be assumed for design purposes.

Surcharge pressure due to trafficking (P_s)

The imposed pressure from vehicle trafficking is largely dependant on the depth of cover above the pipe. Consequently construction traffic may pose the worst case load condition, particularly if precautions are not taken on site, as cover depths are commonly less than when construction is complete. Surcharge loads, calculated using Boussinesq's theory, may be derived from figures 3.2.4 & 3.2.1.

Pipes laid near railway lines are also subjected to dynamic loading. Two catagories of design loading are generally adopted for design. Type RU loading covers all current and projected rolling stock on UK railways. Type RL loading covers only passenger rapid transit systems. The vertical stress at the appropriate depth for both types of loading is given in fig 3.2.2 for single track loading. Where multiple tracks occur, the vertical stress should be multiplied by an appropriate factor taken from fig 3.2.3.

Deflection Lag factor (D_L)

An empirical factor used to account for relaxation, or creep, of the pipe/soil system and other general long-term settlement effects. A conservative design approach is taken by assuming no beneficial effect is derived from frictional forces between the trench walls and backfill material, in addition to the use of a long-term pipe stiffness parameter. Values generally range from 1.0 to 1.5, dependant on the type of pipe surround used and its level of compaction, given in table 3.2.3.

A well installed gravity flow pipe, utilising a single sized granular bed & surround, a value of 1.0 is typically taken for the deflection lag factor.

Deflection Co-efficient (K_X)

A bedding factor used to represent the extent of lateral support provided by the pipe bedding. Pipes receiving support over the full 180° lower half of the pipe a value of 0.083 should be used, whereas bedding providing only a line load support a value of 0.100 would be more appropriate. Please refer to table 3.2.3 for a deflection co-efficient appropriate to the classification of bed & surround used.

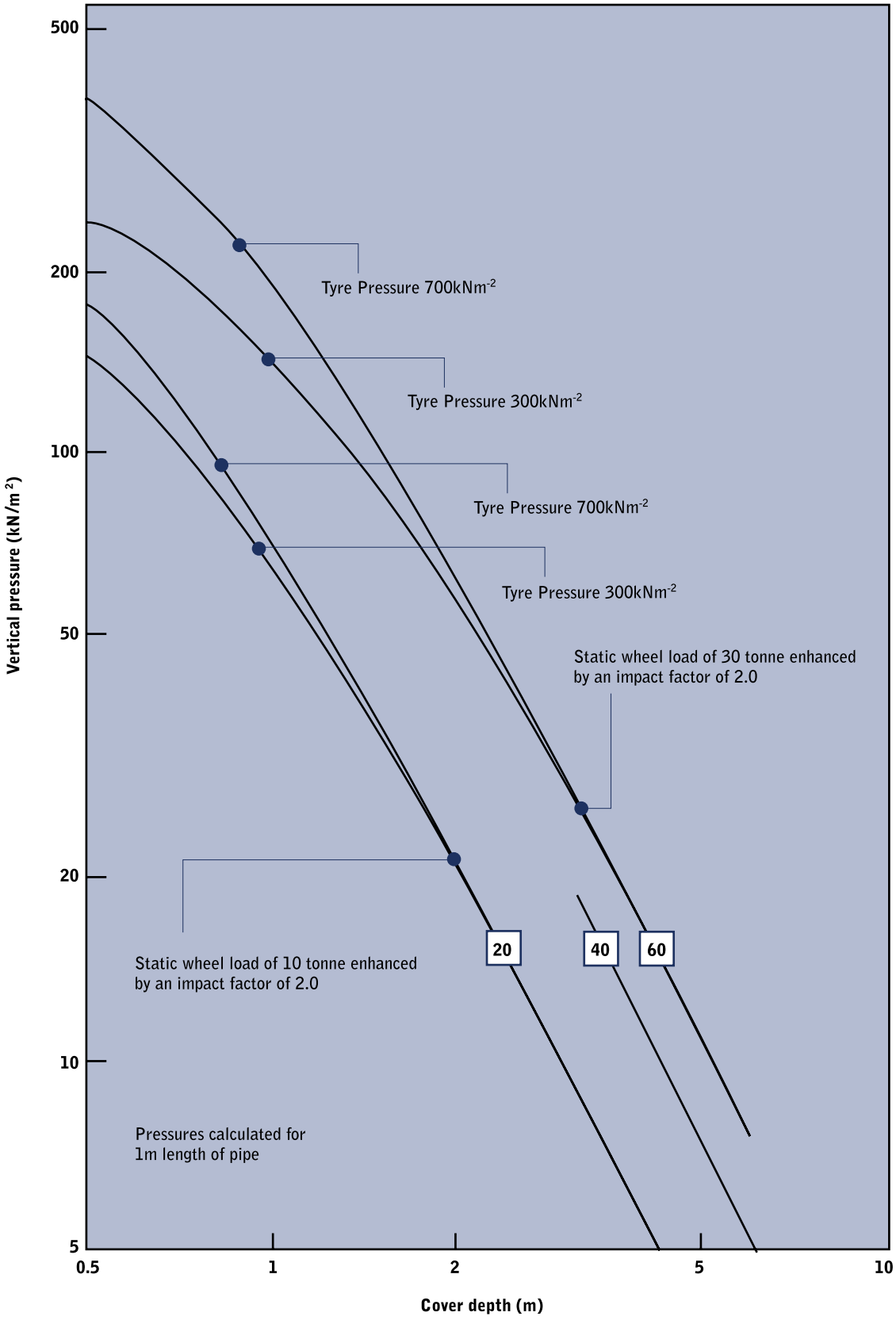
Soil modulus (E', E'$_2$ & E'$_3$)

Soil modulus is the parameter with the most influence on the structural calculation, as soil stiffness will generally be significantly greater than the pipe stiffness. Modulus values have been determined from empirical measurements and are indicated in table 3.2.5 & 3.2.6 for the native soil and pipe bed & surround material respectively.

Where the native soil forming the trench walls is a weak material, the level of support provided by this material will be significantly lower than an engineered pipe surround.

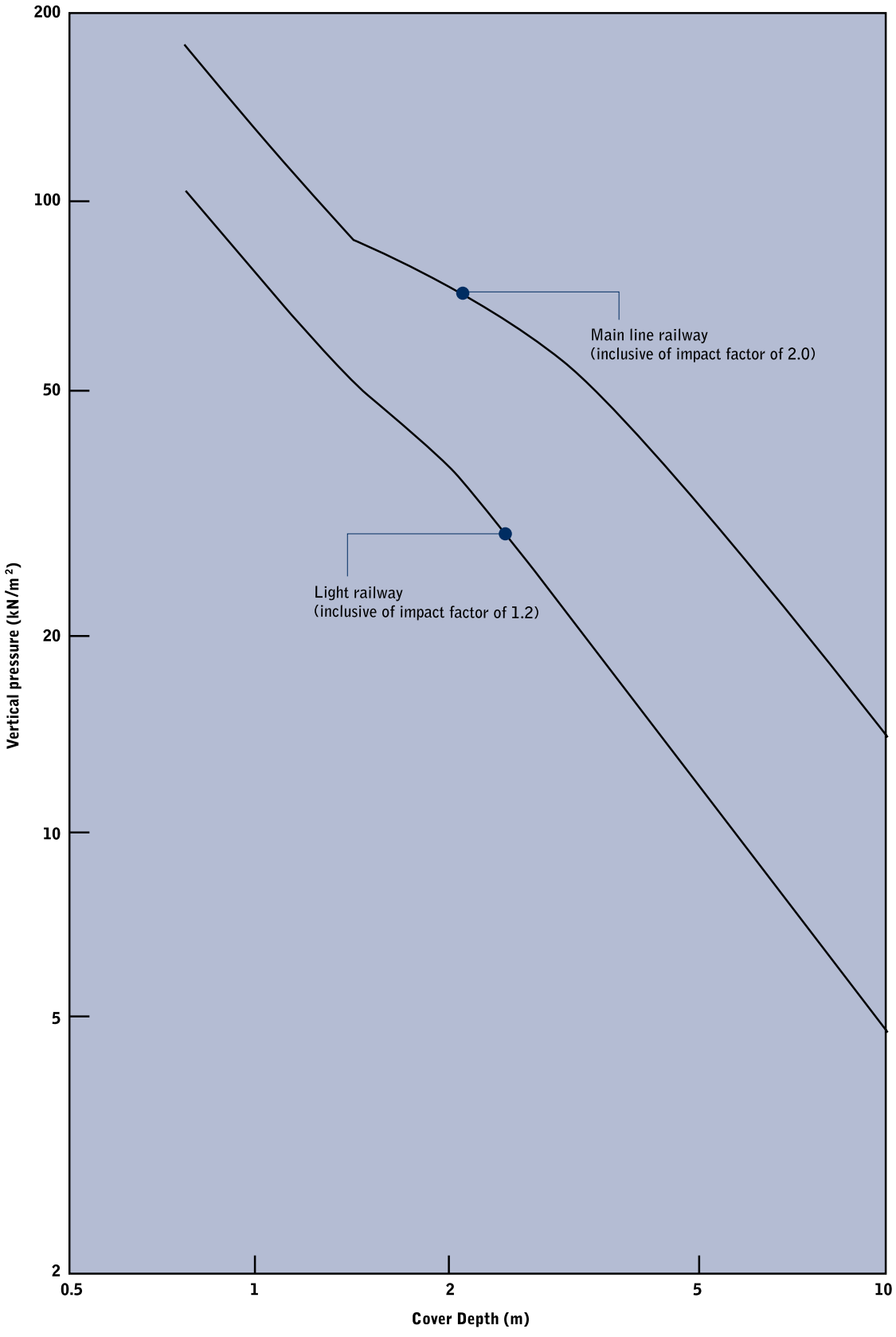
Therefore only considering the modulus of the engineered pipe bed & surround would over estimate the overall modulus of the pipe/soil system. The soil modulus adjustment factor (C_L), is used to take into account the influence of native soil properties on the overall soil modulus (E').

Figure 3.2.1 Design Chart for Construction Traffic Loading



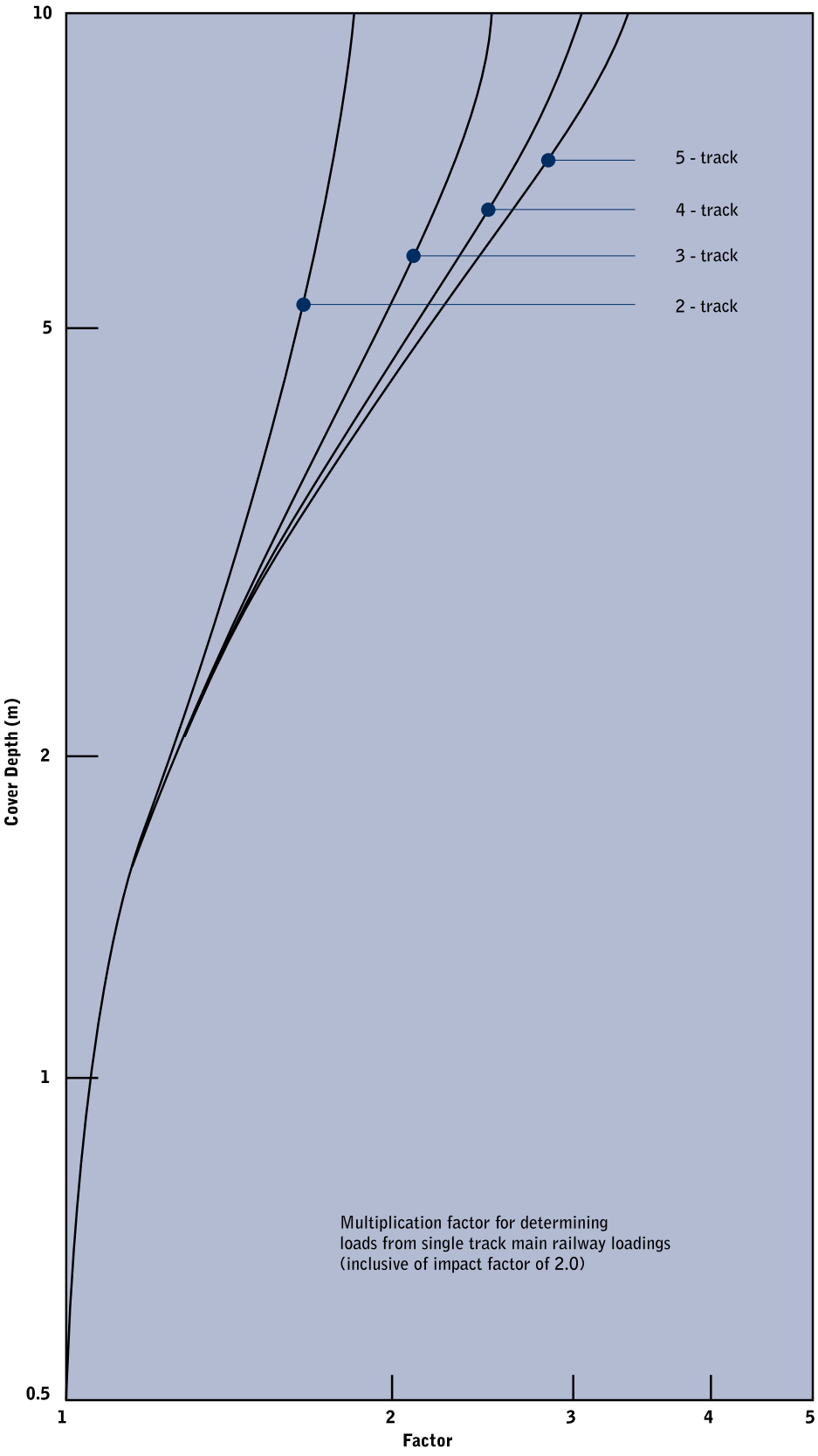
Reference (BS EN 1295-1)

Figure 3.2.2 Design Chart for Single Track Railway Loading



Reference (BS EN 1295-1)

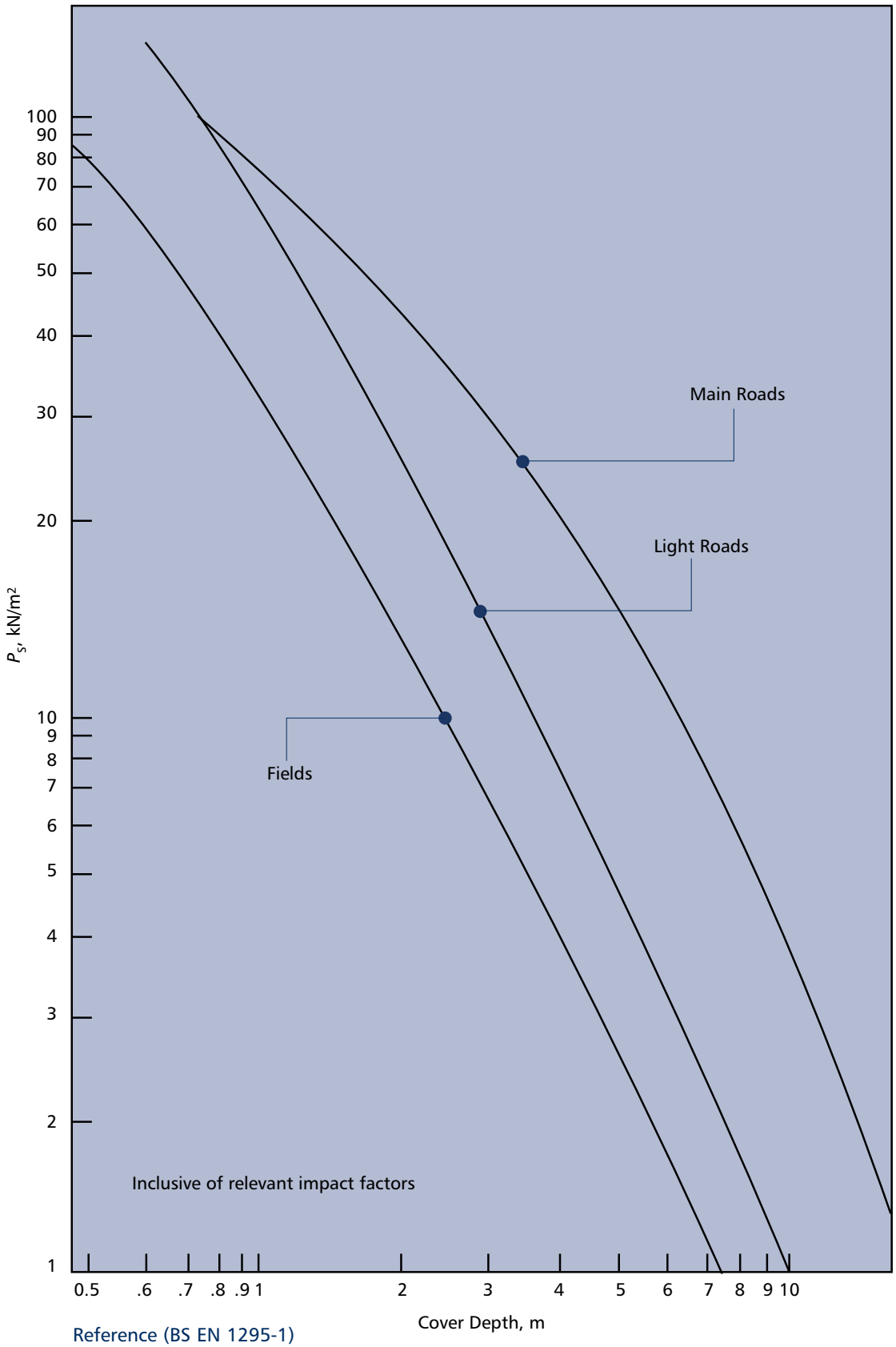
Figure 3.2.3 Factor for Calculating Multi-Track Railway Loading



Reference (BS EN 1295-1)

Ridgidrain Advanced Drainage System

Figure 3.2.4 Surcharge Pressure P_S due to vehicle wheels



Reference (BS EN 1295-1)

It should be noted that the advice and guide values provided by this manual and BS EN 1295, for the various design parameters, is generally conservative. These values are provided to facilitate design, where precise details of types of soil and installation conditions are not available. The choice of design assumptions is left to the judgement of the engineer.

3.2.2 Prediction of buckling resistance

The buckling resistance of buried, flexible non-pressure pipelines is a combination of the pipes inherent buckling resistance and support afforded by the pipe surround. The critical buckling pressure of a buried pipe is substantially greater than that for unrestrained pipes subject to external loading.

BS EN 1295-1:1995, recommends buckling calculations be performed to ensure that a sufficient factor of safety exists when the critical buckling pressure is compared against actual buckling pressure.

It should be noted that when performing the following calculation with a weak native soil, the resultant factor of safety may fall just below the recommended value of 2.0. In Polypipe's experience, buckling has not been a critical mode of failure where pipe deflections are less than 15%.

A buckling check with a factor of safety just below the recommended minimum, despite a predicted level of deformation within the appropriate performance limit, may be attributed to how the buckling calculations use short and long-term pipe modulus.

Stiffness (commonly also known as Young's modulus) may be defined as: $E = \sigma/\varepsilon$

Where: E = Young's Modulus (kN/m^2)
σ = Stress (kN/m^2)
ε = Strain (dimensionless)

NOTE: In this instance strain relates to the amount of pipe deflection.

This equation shows that, if stress is constant and strain (deflection) increases, then a material's modulus must therefore decrease. This empirical relationship holds true for laboratory-based creep testing of the pipe - where the pipe deflection (strain) is not limited or restrained. Therefore as deflection of the pipe increases over time, it's modulus apparently decreases - leading to a lower long term stiffness value.

If making a similar assumption for pipes installed in the ground, where the imposed load (stress) is assumed to be constant after backfilling. If a pipe continues to deflect (an increase in strain) over time, according to the above empirical relationship the pipe modulus must therefore decrease. However research has shown that exhumed pipes do not decrease in stiffness but in fact have a post-installation stiffness equal to, or actually higher, than that when it was manufactured.

Passive earth pressures generated in the side-fill restrict deformation of a pipe buried in the ground. Once installed, any significant increase in pipe deformation requires the pipe and soil structure to creep or deform, or a change in the imposed loading to occur. The stiffness of the backfill surrounding the pipe (vastly superior to that of the pipe itself) plays the most significant part in this pipe/soil system.

Buckling check with soil support:

Factor of Safety, $F_s = \dfrac{1}{(P_e/P_{crl})+[(P_s+P_v)/P_{crs}]} \geq 2.0$

Where: $P_{cr}^* = 0.6(EI/D^3)^{0.33}.(E')^{0.67}$

*The long and short term values of the pipe modulus (E) are used to calculate (P_{crl} and P_{crs} respectively) the critical pressure for buckling of flexible pipes.

Where the depth of cover is less than 1.5m, an addition check is performed to mimic the temporary case of adjacent excavations.

Buckling check without soil support:

Factor of Safety, $F_s = \dfrac{P_{crs}}{(P_e+P_v)} \geq 1.5$

Where: $P_{crs}^* = 24 \times EI/D^3$ [*The short term value of pipe modulus (E) is used to calculate P_{crs}]

3.2.3 Design Example

Product	600mm Ø Ridgisewer (SN4)
Application	Adoptable sewer beneath an A-road
Burial Depth	3.0m to pipe crown
Native Soil	Very loose gravel

Ovalization, $\frac{\triangle}{D} = \frac{K_x [(D_L P_e)+P_s]}{(8EI/D^3)+ (0.061E')}$

P_e = 19.6 x 3.0
= 58.8 kN/m²

No soil density data available, therefore 19.6 kN/m³ assumed. (Clause NA. 6.3 BS EN 1295-1)

P_s	= 26 kN/m²	(Figure 3.2.4)
D_L	= 1.0	(Table 3.2.5)
Kx	= 0.083	(Table 3.2.5)
EI/D^3	= 1.74 kN/m²	(Polypipe Civils Technical Data) (Table 2.4.2)

Overall Soil Modulus, $E' = E'_2 C_L$

(Table 3.2.5)
(Class S1 - Gravel (single size))
Bed & surround soil modulus, E'_2 = 10 MN/m²

Calculation of soil modulus adjustment factor, C_L

Pipe O.D., B_C	= 672mm
Trench width, B_d	= B_C + 300mm
	= 972mm

(Table 3.2.6)
Assuming native soil is a Very Loose Gravel
Native Soil Modulus, E'_3 = 3 MN/m²,

$$C_L = \frac{0.985+[0.544(972/672)]}{[1.985-0.456(972/672)](10/3)-[1-(972/672)]}$$

C_L = 0.3642
Overall Soil Modulus, E' = 10 MN/m² x 0.3642
= 3.642 MN/m²

Ovalization, $\frac{\triangle}{D} = \frac{0.083[(1.0 \times 58.8)+26.0]}{(8 \times 1.74)+(0.061 \times 3642)}$

= 0.0298
Deflection, △ = 0.0298 x D
= 0.0298 x 0.672m = 0.020

Percentage Deflection = (0.020 / 0.587) x 100
= 3.41% ≤ 6.0
Therefore acceptable

Cover depth is >1.5m, therefore buckling check with soil support only is required.

3.2.4 Buckling check with soil support

Factor of Safety, $F_S = \frac{1}{(P_e/P_{crl})+[(P_s+P_v)/P_{crs}]}$

Where: P_{crl} = $0.6(1.74)^{0.33}.(3642)^{0.67}$ kN/m²
= 0.6 x 1.201 x 243.275 kN/m²
= 175.30 kN/m²

P_{crs} = $0.6(7.83)^{0.33}.(3642)^{0.67}$ kN/m²
= 0.6 x 1.972 x 243.275 kN/m²
= 287.84 kN/m²

Factor of Safety, F_S = 1/0.426
= 2.34 ≥ 2.0 Therefore adequate

Table 3.2.5 Modulus of Soil Reaction

Embedment Class as table NA.8 and deflection coefficient K_x	Compaction Mp %	Modulus of Soil reaction E'_2 MN/m^2	Deflection Lag factor D_L[2]	Strain factor Df for various pipe stiffness[1] kN/m^2					
				1.25	2.5	5.0	10	15	30 or more
Class S1	Uncompacted	5	1.5	4.7	4.5	4.3	4.0	3.75	3.0
Kx = 0.083	80	7	1.25	4.7	4.5	4.3	4.0	3.75	3.0
	85	7	1.0	4.7	4.5	4.3	4.0	3.75	3.25
	90	10	1.0	4.7	4.5	4.3	4.0	3.75	3.5
	95	14	1.0	-	-	-	-	3.75	3.5
Class S2	Uncompacted	3	1.5	4.7	4.5	4.3	4.0	3.75	3.0
Kx = 0.083	80	5	1.25	4.7	4.5	4.3	4.0	3.75	3.0
	85	7	1.0	4.7	4.5	4.3	4.0	3.75	3.25
	90	10	1.0	4.7	4.5	4.3	4.0	3.75	3.5
	95	20	1.0	-	-	-	-	3.75	3.5
Class S3	85	5	1.5	6.2	5.5	4.75	4.25	4.0	3.25
Kx = 0.100	90	7	1.25	7.75	6.6	5.5	4.7	4.25	3.5
	95	14	1.0	-	-	-	-	4.75	3.5
Class S4	85	3	1.5	6.2	5.5	4.75	4.25	4.0	3.5
Kx = 0.100	90	5	1.25	7.75	6.6	5.5	4.7	4.25	3.5
	95	10	1.0	-	-	-	-	4.75	3.5
Class S5	85	1	3.0	-	-	-	-	4.0	3.5
Kx = 0.100	90	3	2.0	-	-	-	-	4.25	3.5
	95	7	1.25	-	-	-	-	4.5	3.5
Class B1	85	5	1.5	-	-	-	5.0	4.0	3.5
Kx = 0.083	90	7	1.25	-	-	-	5.5	4.25	3.5
Class B2	85	3	2.0	-	-	-	5.5	4.25	3.5
Kx = 0.083	90	5	1.75	-	-	-	6.0	5.0	3.5

(1) Pipe stiffness referred to in this table are initial values.
(2) Where the designer can be certain that intial pressurisation will take place within one year of backfilling, a value of 1.0 may be taken for the deflection lag factor.

Note 1. For construction details of embedment classes see table NA8.
Note 2. Quoted values of E'_2 assume pipe line will be installed below ground water.
Note 3. Mp indicates modified proctor density and corresponds to the heavy compaction test in BS 1377.
Reference (BS EN 1295-1)

Table 3.2.6 Modulus of Soil Reaction for Native Soils in Various Conditions E'

Soil Type	Modulus of soil reaction (kNm^{-2} $x10^3$)				
	Very Dense	Dense	Medium Dense	Loose	Very Loose
Gravel	Over 40	15 - 40	9 - 15	5 - 9	3 -5
Sand	15 - 20	9 - 15	4 - 9	2 - 4	1 - 2
Clay, silty sand	10 - 15	6 - 10	2.5 - 6	1.5 - 2.5	0.5 - 1.5
Clay	Very hard	11 - 14			
	Hard	10 - 11			
	Very stiff	6 - 10			
	Stiff	4 - 6			
	Firm	3 - 4			
	Soft	1.5 - 3			
	Very soft	0 - 1.5			

Velocities and flow rates for thermoplastic structured walled pipes can be calculated using either the Manning or Colebrook-White equations. The Colebrook-White equation forms the basis of this guide as it has been shown to provide accurate results for a wide range of flow conditions and is the method commonly used in the UK.

For circular pipes flowing full, the Colebrook-White equation may be expressed as:

$$v = -2\sqrt{(2gS_fD)}\log_{10} \times \left[\frac{k_s}{3.7D} + \frac{2.51v}{D\sqrt{(2gS_fD)}}\right]$$

Where: v = Mean water velocity

g = Gravity

S_f = Hydraulic gradient, (h_f / L)

D = Internal pipe diameter

k_s = Pipe roughness

V = Kinematic viscosity

An alternative approach is required when utilising the Colebrook-White equation to determine either the pipe diameter or hydraulic gradient variables.

Hydraulic gradient (S_f)

Hydraulic gradient is governed by the pipe slope.

Pipe roughness (k_s)

A mean measurement of the height that surface roughness projects from the pipe wall. Measured in terms of an equivalent sand roughness.

Sewer type and age will influence the choice of pipe roughness. Except for calculating initial flow conditions, consideration should also be given to environmental factors, such as sediment and biological slime deposits.

Typical values of roughness (Ks), for use in the Colebrook-White equation, are given in table 3.3.1

Hydraulic Properties

Table 3.3.1 Selected Roughness Coefficient Values (ks)

MATERIAL	SUITABLE KS VALUES (mm) GOOD	NORMAL	POOR
CLEAN AND NEW PIPES			
Twin wall pipes with coupling joints	0.003	0.006	-
Standard pipes with spigot and socket joints and O-ring seals at 6 to 9m intervals	-	0.06	-
SLIMED SEWERS			
Flowing half full, velocity approximately 0.75 ms^{-1}	-	0.6	1.5
Flowing half full, velocity approximately 1.2 ms^{-1}	-	0.15	0.3

However certain codes of practice, such as Sewers for Adoption 6th Edition (SFA), stipulates a minimum pipe roughness, irrespective of the sewer type.

Where: Foul gravity sewer design Ks = 1.5mm (Clause 2.12 SFA)

Surface water sewer design Ks = 0.6mm (Clause 2.13 SFA)

As can be seen from table 3.3.1 these values are very conservative. The very low surface energy inherent with thermoplastic pipes, makes significant biological growth or adhesion of other materials unlikely to occur. A value of 0.009 is recommended for the roughness coefficient when Mannings equation is used. All charts in this section are based on the Colebrook-White equation.

Kinematic viscosity (v)

Kinematic viscosity is a ratio of a fluids viscosity and density.

Viscosity is independent of pressure and depends on temperature only, therefore, values vary according to the type of fluid and its ambient temperature.

For design purposes 1.141 x 10^{-6} m^2/s may be used (Water at 15°C).

The volume of flow may then be calculated using the continuity equation.

$$Q = \nu A$$

Where:
- Q = Flow rate (m^3/s)
- ν = Water velocity
- A = Cross-sectional area of pipe bore

Determining the correct pipe size, gradient or discharge capacity using the Colebrook-White equation is an iterative process. Both graphical and tabular methods have been published to assist in the determination of a pipes hydraulic property. Typically a chart or table, valid for a particular pipe roughness, details four dependant variables (D, Sf, v & Q). Therefore if any two variables are known, it is possible to determine the remaining two variables.

Extensive work has been carried out in this field by H.R. Wallingford, who have published data in a tabular format. (H. R. Wallingford and D.I.H. Barr; "Tables for the hydraulic design of pipes, sewers and channels"; 7th Edition, Volume 1.)

Figures 3.3.2, 3.3.3 and 3.3.4 are graphical examples, based on typical roughness co-efficients used in structured thermoplastic pipe design.

Figure 3.3.2 Flow Chart for ks=0.06mm

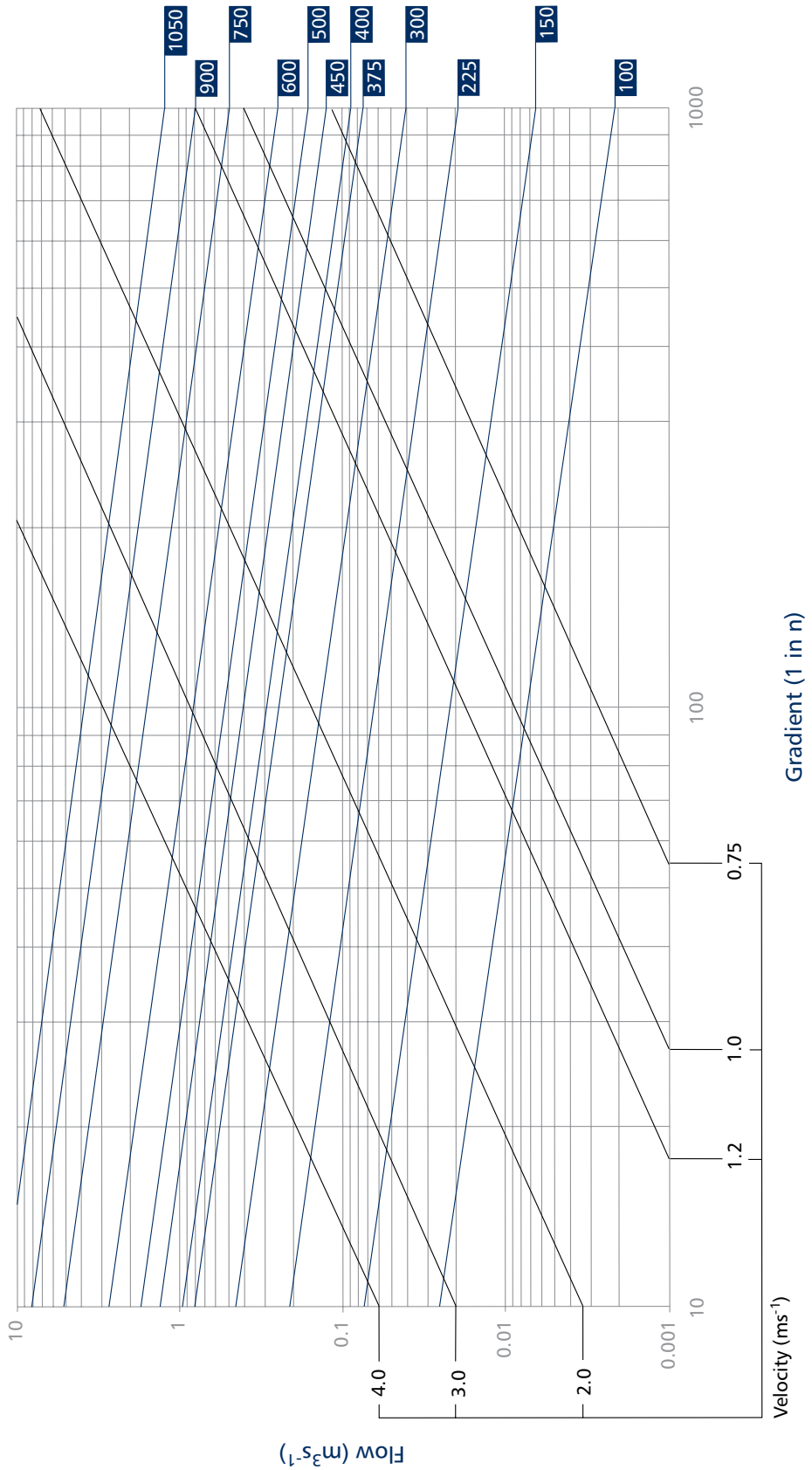


Figure 3.3.2 Flow Chart for ks=0.6mm

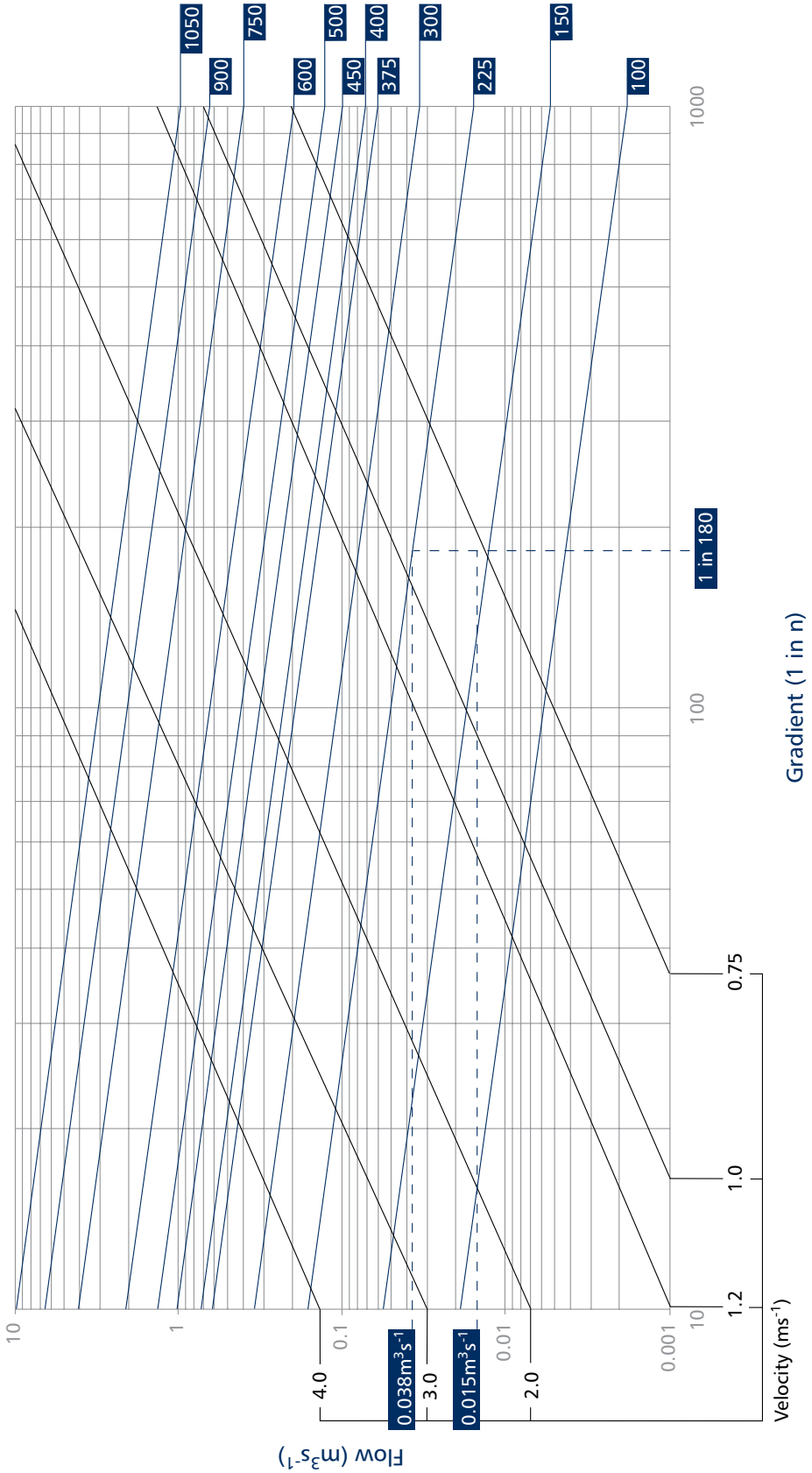
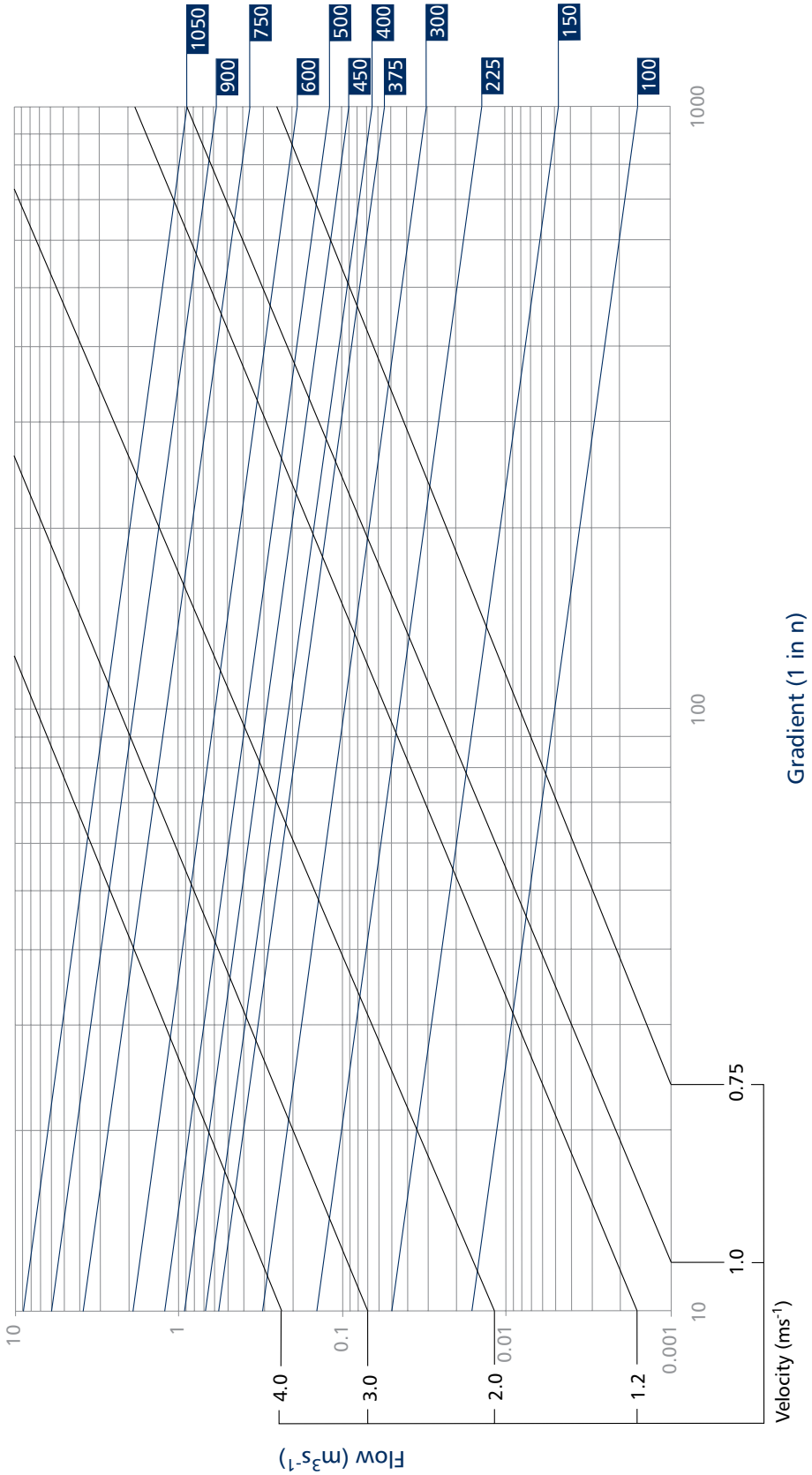


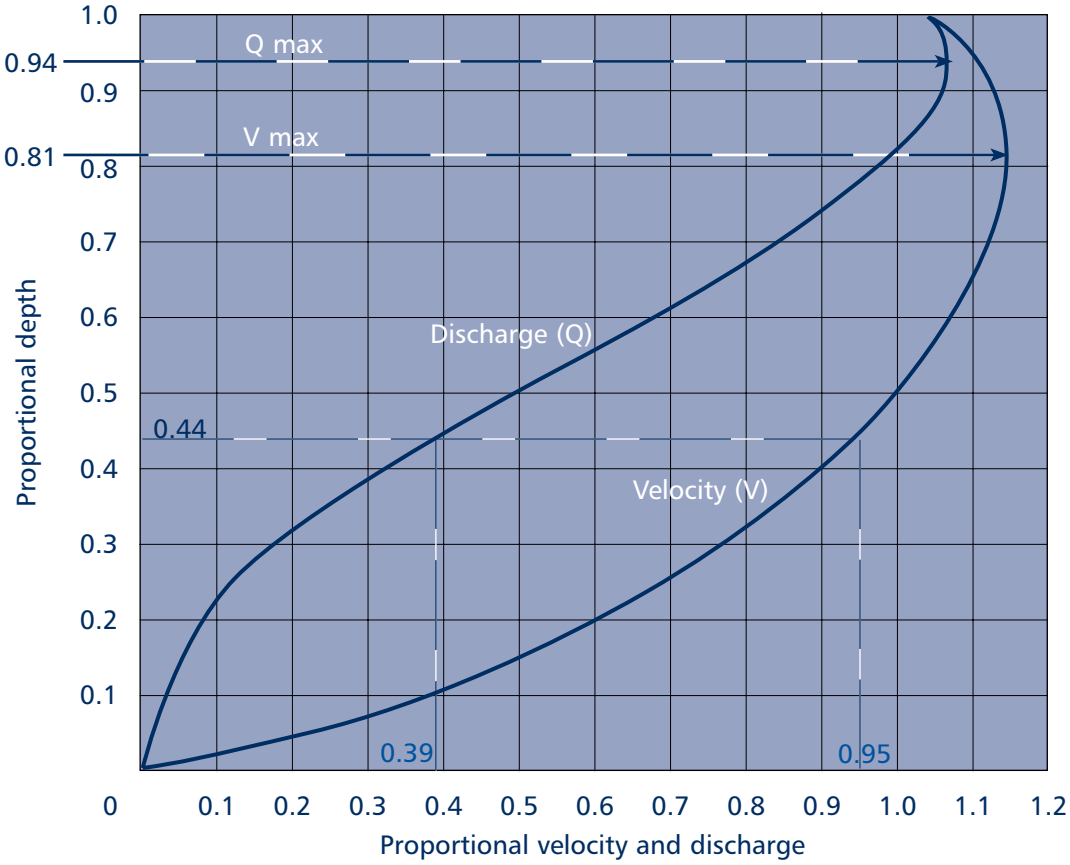
Figure 3.3.4 Flow Chart for ks=1.5mm

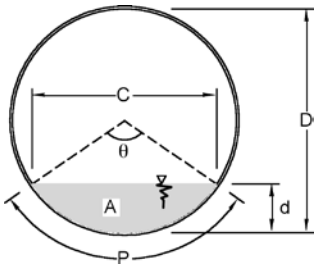


Urban drainage pipes commonly flow part-full, with the depth of water affecting the hydraulic conditions.

Figure 3.4.1 Proportional Velocity and Discharge

Figure 3.4.1 gives a relationship of part pipe flow fluid velocity and discharge against full pipe flow.
Once a proportional depth is determined, figure 3.4.1 may be used to determine an appropriate factor to apply to full flow values.





$$n = 2\cos^{-1}\left[1 - \frac{2d}{D}\right]$$

$$A = \frac{D^2}{8}(n - \sin n)$$

As can be seen from figure 3.4.1 hydraulic conditions vary with depth of pipe flow. Frictional losses occur between the pipe wall and fluid. As water depth varies, the ratio of wetted perimeter and area of flow changes. At low flow depths the ratio of wetted perimeter to flow area is high. This ratio decreases, as depth increases, until d approaches D. As the pipe flow nears full conditions, any increase in flow depth results in a significant increase of wetted perimeter compared with flow area. As can be seen in figure 3.4.1, this results in maximum flow velocity occurring at near pipe full conditions.

Minimum Gradients

Sedimentation reduces a pipe systems hydraulic capacity, increases pollution concentration and in extreme cases may lead to partial or complete blockages. Minimum pipe gradients are therefore specified to ensure the pipe flow regularly achieves a 'self-cleansing' velocity, limiting long-term sedimentation.

A velocity flow of 0.75m/s is typically used as the minimum self-cleansing velocity in system design. However, certain applications are required to comply with particular codes of practice.

• Non-adoptable drainage, within a properties curtilage, is defined by The Building Regulations. Prescribing specific minimum pipe gradients for small diameter sewers.

Sewer systems proposed for adoption should be designed in accordance with Sewers For Adoption (6th Edition). It specifies that foul sewers should achieve a minimum flow velocity of 0.75m/s at one-third design flow and surface water sewers 1.0m/s at pipe full flow.

Design Example

Pipe Size Determination

A pipeline is to carry a discharge of 0.015 cubic metres per second (15 litres per second) when laid at a gradient of 1 in 180.

Data:	Design discharge (Q)	= 0.015m^3/s
	Pipe gradient (S)	= 1 in 180
	Roughness height (ks)	= 0.6mm

Using Figure 3.3.3 for ks = 0.6mm, find the intersection point of a discharge of 0.015m^3s^{-1} on the left hand scale and a gradient of 1 in 180 on the bottom scale. The intersection point yields the following:

	Pipe size selected	= 225mm
	Discharge capacity	= 0.038m^3/s at full bore flow

Using a rearrangement of the continuity equation,

$$\text{Velocity} = \frac{Q}{A} = \frac{0.038m^3/s}{0.040m^2} = 0.95m^3/s \text{ at full bore flow (above the self-cleansing velocity of 0.75m/s}$$

Velocity

As the discharge capacity of the pipe exceeds the design discharge, the flow velocity should be checked.

Step 1: Calculate the proportional discharge.
This is the ratio of the design discharge to the full bore flow discharge capacity.

Proportional discharge

$$= \frac{0.015m^3/s}{0.038m^3/s}$$

$$= 0.39$$

Step 2: Using Figure 3.4.1, the proportional discharge curve (read on the bottom scale) yields a proportional depth of 0.44 (read on the left scale). A proportional depth of 0.44 yields a proportional velocity of 0.95.

Step 3: Calculate the velocity of the design discharge by multiplying the full bore flow velocity by the proportional velocity.

0.95 x 0.95m/s = 0.90m/s

Therefore, the velocity of flow at the design discharge exceeds the self-cleansing velocity.

Abrasion Resistance

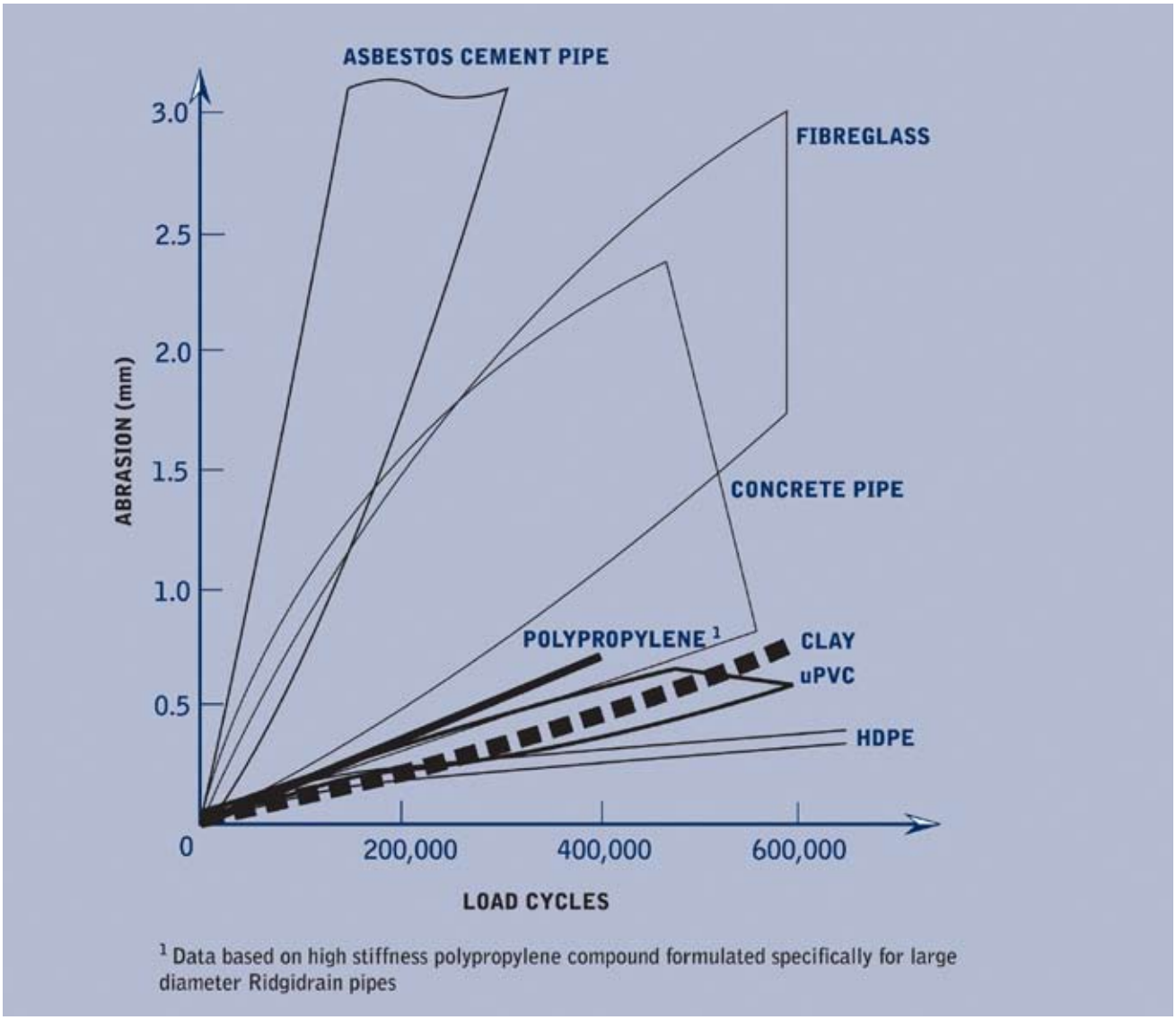
Plastic pipe materials have excellent resistance to abrasion and are typically the material of choice for slurry pipelines associated with mining and quarrying.

Comparative testing performed by the University of Darmstadt detailed in Figure 3.4.2 clearly demonstrates that high density polyethylene and polypropylene have superior abrasion resistance to rigid pipes manufactured from traditional materials.

Ridgisewer pipes are manufactured in polypropylene (PP) and Polysewer pipes are manufactured in uPVC.

Ridgidrain pipes 100 - 375mm are manufactured in High Density Polyethylene (HDPE) and 400 - 1050mm are manufactured from Polypropylene (PP).

Figure 3.4.2 Abrasion Resistance



Ultraviolet light resistance

As standard, Ridgidrain, Ridgisewer & Polysewer products are designed and manufactured from materials with sufficient resistance to withstand the potential effects of ultraviolet light for periods of up to 3 months. The initial effects of exposure to ultraviolet light are limited to colour changes. A much longer period of exposure would be necessary before the structural or mechanical properties of the products could be affected. Due to aesthetic considerations uncovered storage for periods longer than approximately 3 months (BBA) is not generally recommended.

Thermal characteristics

All components of the Ridgisewer & Polysewer system are suitable for use over a wide range of temperatures.

Table 3.4.3 Thermal Resistance

DIAMETER	MAXIMUM TEMPERATURE °C	MAXIMUM CONTINUOUS TEMPERATURE °C
Polysewer	75*	Contact the technical department for individual advice
Ridgisewer	100	80
Ridgidrain	80	60

*Based on intermittent exposure to temperature.

Extra care in handling may be required at temperatures below 0°C.

Ridgisewer & Polysewer pipes are most commonly installed underground where the effects of thermal expansion are restrained by friction between the pipe and its bed and surround material. The effects of thermal expansion should be considered for any installations in which the pipes are not fully restrained. Commonly accepted values for the coefficient of thermal expansion are provided in table 3.4.4.

Table 3.4.4 Thermal Expansion

MATERIAL	COEFFICIENT mm/mK
PVC	0.08
PP	0.14
PE	0.17

Chemical Resistance

All of the materials' used in the Polypipe's thermoplastic structured wall pipe systems have excellent chemical resistance characteristics, especially when compared with traditional materials such as concrete. For example, sulphates and sulphuric acid (non fuming) have no measurable effect on polyethylene and polypropylene yet are severely detrimental to ordinary concrete.

However, under rare conditions there are substances that can have an effect on plastic and rubber materials and detailed chemical resistance information is available in the following standards:

• CP312:Part 1:1973	Code of practice for plastics pipework (thermoplastics material) General principles and choice of material
• BS ISO 4433-2:1997	Thermoplastics pipes - Resistance to liquid chemicals - Classification Part 2: Polyolefin pipes
• BS ISO 4433-3:1997	Thermoplastics pipes - Resistance to liquid chemicals - Classification Part 3: PVCu
• ISO/TR 10358:1993	Plastic pipes and fittings - Combined chemical resistance classification table
• ISO/TR 7620:2005	Rubber materials - Chemical resistance

A number of statements can be made on the chemical resistance of the Polypipe's thermoplastic structured wall pipe system. Under typical installation conditions the system is:

- Unaffected by pH in the range of 0.1 - 14
- Unaffected by inorganic salts in any concentration, including heavy metals.
- Unaffected by dilute aqueous solutions of organic chemicals such as detergents.
- Unaffected by low concentrations of hydrocarbons and oils in normal use, such as run-off from roads and car parks. Where hydrocarbons are present in higher quantities, for example a garage forecourt, nitrile seals should be specified in place of the standard EPDM seals upstream of the separator.
- Unaffected by any naturally occurring compound in soils, including humic and fulvic acids found in peaty soils.
- Unaffected by sulphates in any concentration and sulphuric acid (non-fuming).
- Affected only by a limited number of industrial chemicals that are only rarely found in the environment in sufficient concentration to be detrimental to the Polypipe's thermoplastic structured wall pipe systems. This may only occur in heavily contaminated industrial sites where concentrations may be high enough to warrant further investigation. Disposal of industrial chemicals into drains should not occur due to environmental regulations. Spillages should be contained and result in short-term exposure and it should be noted that any effects may be reversible and are dependent on concentration, frequency and duration of exposure.

The current world-wide inventory of industrial chemicals extends to many millions of compounds and no definitive list detailing their effect on polymers exists. For further information or detailed advice, contact the Technical Department at Polypipe Civils Limited. The following information is required in order to evaluate fully the suitability of Polypipe's thermoplastic structured wall pipe products for any given application:

- The chemical(s)
- The concentration of the chemical(s)
- The frequency and duration of exposure
- The maximum temperature of the chemical(s)
- The design life of the pipe system

Safety & General Advice

Ridgisewer and Ridgidrain ADS products should be transported, handled and installed in accordance with the requirements of BS5955:Part 6:1980 and, for applicable contracts, the Highways Agency Manual of Contract Documents for Highway Works and Sewers for Adoption.

Storage and Handling Recommendations

Pipes up to 400mm in diameter are supplied in pallets which should be carried by a forklift or similar vehicle and should not be dropped from the delivery or craned by their timber frames. If pallets are craned soft slings should be used. Pallets may be stacked up to a height of 3 pallets as shown but only if carefully stacked on firm, level ground. Care should be taken when cutting the steel strapping as it could flail and cause injury. 450mm and larger pipes are normally supplied in individual lengths but may also be palleted. Loose pipes should be stored between securely anchored supports not more than 1.8m apart. Loose pipes should not be thrown, dropped or dragged along the ground.

Care should be taken to ensure that pipes, particularly those with integral sockets, are not damaged during unloading and/or transport on site. Extra care should be taken at temperatures below 0ºC.

Pallets or pipes should be supported at a minimum of two places during mechanical handling operations and care should be taken to ensure that they are not damaged by slings or forks. Hooks should never be used.

Couplings and fittings may be supplied individually, in bulk bags or on shrink wrapped pallets. Note that shrink wrapping is not designed to be load bearing.

Uncovered storage is subject to the recommendations provided in the section on ultraviolet light resistance.

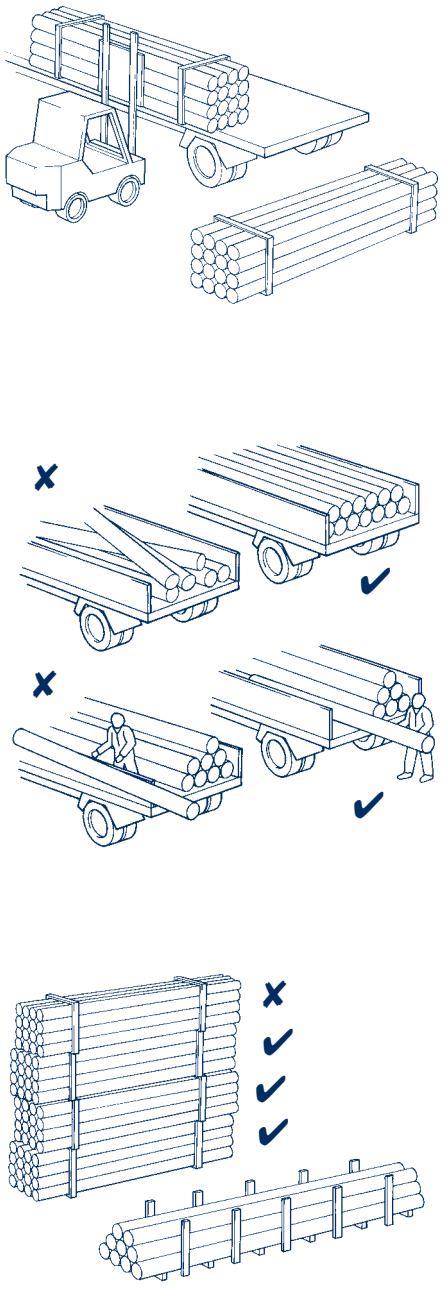


Figure 3.5.1 Storage and Handling Recommendations

General Handling

Polyethylene (PE), uPVC and polypropylene (PP) materials are not considered to be skin irritants. Fine particles may cause irritation if they get into the eyes. uPVC and PP are chemically stable at normal temperatures. There are no known toxic, dermatitic or environmental hazards associated with Ridgisewer, Ridgidrain & Polysewer products.

Storage

PE and PP should not be stored in contact with very strong oxidising acids.

Fire Hazards

PE, uPVC and PP are combustible but burn slowly. In a fire they will melt and burning droplets may fall and propagate the fire. In the event of a fire the use of water jets should be avoided in the early stages and water sprays used instead. Water sprays, foam, CO_2 and dry powder may be used.

Comprehensive COSHH data sheets are available from Polypipe Civils Technical Department.

Disposal

Uncontaminated waste can be recycled into other products. If disposed in landfill uPVC, PE and PP do not emit dangerous gases or contribute to groundwater pollution.

Comprehensive COSHH data sheets are available from the Polypipe Civils Technical Department.

Table 3.5.2 Pallet Quantities

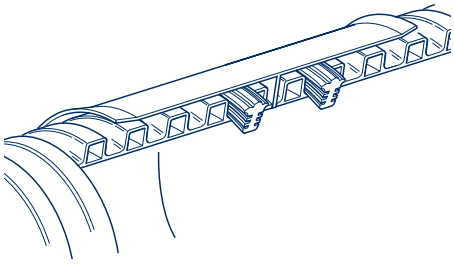
NOMINAL SIZE mm	NUMBER OF LENGTHS PER PALLET	PRODUCT
100	85	Ridgidrain
150	46	Polysewer & Ridgidrain
225	23	Polysewer & Ridgidrain
300	9	Polysewer & Ridgidrain
375	5	Ridgidrain
400	5	Ridgisewer & Ridgidrain
450	2	Ridgisewer
500	2	Ridgisewer
600	2	Ridgisewer

All other diameters are supplied in individual lengths as standard

Jointing Systems

Ridgisewer and Ridgidrain ADS pipes are manufactured with two types of jointing system.

Separate double socket couplings



Integral sockets

Available with Pipe diameters 400 - 900mm

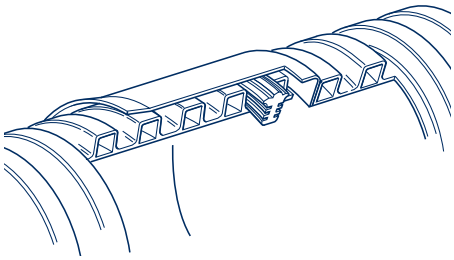


Figure 6.2 Jointing Systems

Sealed Systems

Polypipe's structured walled pipe systems are leak tight when installed in accordance with the relevant recommendations (Sections 1.5 & 2.5).

The sealing systems currently comply with Method 4 of BS EN 1277:2003. Joints are tested to +0.5 and –0.3 Bar of pressure (it should be noted that Polypipe's structured walled pipe systems are designed for gravity applications only).

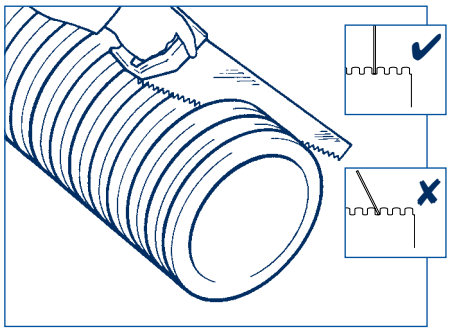
Recommended maximum angular deviation limits at joint sockets are as follows:

100 - 600mm	3°
750mm and larger	1°

Jointing Instructions

This advice applies to all Polypipe structured walled thermoplastic pipes, seals and fittings. Note that sealing rings and lubricant may not be required for unsealed systems.

Components from other manufacturers' systems should not be used without the written permission of Polypipe Civils Limited. Polypipe Civils Limited does not guarantee any part of systems in which unauthorised components have been used.

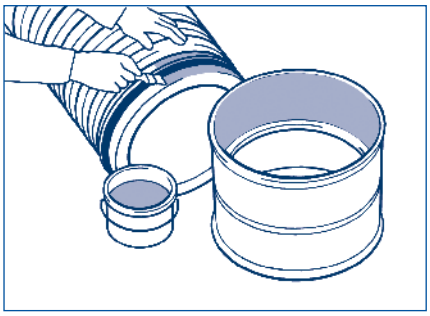


Pipe preparation

The thermoplastic pipes are easily cut to length on site, preferably using a coarse toothed saw or a heavy-duty jigsaw. Cuts should be made midway between corrugations and be square to the pipe. Before jointing, ensure that the ends of the pipe are free of sharp edges, swarf and dirt or grit.

Sealing ring

The correct sealing ring should be lubricated using Polypipe lubricant and fitted between the first and second pipe corrugations. Ensure that the fitted seal is fully seated in the corrugation and is not twisted. Any exceptions on special products will be identified on the product labelling. All Polypipe seals are of the compression type and are not directional.



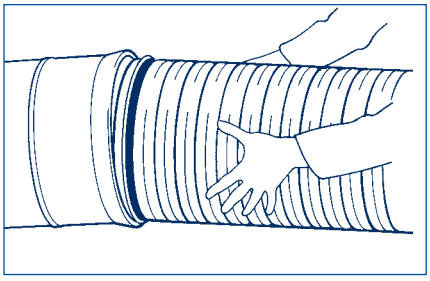
Lubricant

Clean the inside of the coupling, if necessary, and apply sufficient Polypipe lubricant to the sealing ring and inside bores of the coupling, making sure they are kept clean until the joint is made.

Lubricant must be used on all sealed joints.

Fitting the coupling

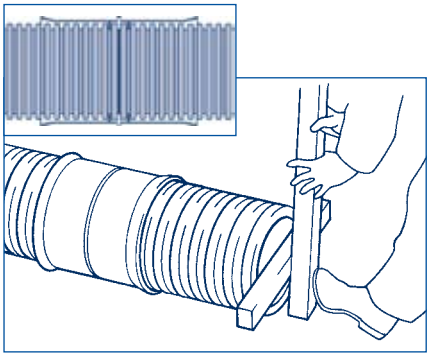
Push the coupling over the seal and onto the pipe until the central register of the coupler butts up to the pipe end. It may be easier to start the pipe into the coupling if pushed at a slight angle initially. Pipes can be supplied either integrally socketed or plain ended. Adaptors are available for the connection to other pipe systems.



Making the connection

Push the pipe fully onto the coupling on the adjacent length by hand or, if required, by levering it into place with timber sections. It is likely that 750mm and larger sizes will require mechanical assistance. Robust timber should be used to protect the pipe and spread the load under these conditions.

It may be easier to start the pipe into the coupling if the pipe is inserted at a slight angle to the coupling initially. Ensure that the alignment of the pipes is satisfactory and that the angular deflection is not excessive.



Trench Preparation

Trenches should not be excavated too far in advance of pipe installation and should be supported by trench boxes where required by Health and Safety requirements.

Trenches should be as narrow as practicable, generally between 300 and 600mm wider than the outside diameter of the pipe. Where multiple pipes are installed in a trench sufficient spacing should be allowed between them to ensure that there are no voids and the material can be fully compacted.

Local soft spots in the trench base should be excavated and filled with a suitable compacted granular material.

The bedding material is laid below the pipe to provide uniform support and to permit small adjustment of the pipe's line and level. In cases where the 'as dug' material is suitable as pipe surround, imported bedding is not required and the trench bottom should be loosened. Otherwise a minimum 100mm bedding depth of granular material should be placed in the trench bottom prior to laying the pipes.

Bricks, stones, blocks of wood or other similar objects should never be placed below the pipe, even temporarily, to facilitate adjustment of line and level. This is because such objects, like large stones, may cause high local stress concentrations and pipe deformations. If objects are placed temporarily beneath a pipe while bedding is added or rearranged, they will rapidly become covered, difficult to locate and easily forgotten.

Pipes should be jointed in accordance with Polypipe Civils recommendations. Air testing in accordance with the advice on page 71 is recommended prior to placement of the sidefill and backfilling to ensure correct workmanship.

Sidefill placement

After a section of the pipe has been installed and successfully tested, the sidefill, the most important structural component of the fill, should be placed. The material should be placed evenly on both sides of the pipe, and compacted in accordance with the specification. Single-sized coarse granular materials, such as stone or gravel, may achieve the necessary density without compaction. Compaction of these materials is recommended where trench walls are relatively soft and weak. For well-graded granular soils compaction will be necessary. It is important that compacting equipment does not come into contact with the pipe at any stage of compaction. The sidefill material should normally extend a minimum 100mm above the pipe crown.

Backfill placement

The backfill material that lies within 300mm of the pipe crown should be free from particles stones exceeding 40mm diameter. Heavy compaction should not be applied until the cover to the pipe is a minimum of 300mm in order to avoid the imposition of large stresses to the pipe. The material that is placed more than 300mm above the pipe crown should be placed and compacted in layers not greater than 300mm thick or in compliance with the specification.

It is important that trench sheets, if used to support the trench, are removed progressively prior to compaction of the sidefill and backfill.

N.B. Refer to sections 1.5 and 2.5 for standard installation details.

Recommendations on Pressure Testing

Structured walled thermoplastic pipes may be tested using conventional air or water testing.

Air Test Method

1. Block the ends of the pipe, including any branches, using sealed, expanding stoppers.
2. Fill a U-tube manometer with water to the correct level, ensuring that there are no trapped air bubbles in the water.
3. Connect the manometer to the appropriate port of one of the stoppers.
4. Increase the pressure in the pipe until a pressure of 100mm of water (0.01 Bar) is reached.
5. Allow the pressure to stabilise for several minutes, increasing the pressure to 100mm head of water if it drops.
6. Record any change in pressure over a 5 minute period. Without further pumping it should not drop below 75mm head of water. Air test problems are generally due to faulty equipment or test procedures and the following advice may be of assistance.

- Always install pipes in accordance with Polypipe Civils recommendations and the applicable specification.
- Check that the test equipment does not leak and is in proper working order by testing a short length of pipe submerged in a water bath.
- Ensure that the test stoppers, tubes and pump are in good condition and that all seals are correctly fitted.
- Ensure that the pipe bores are free from dirt and debris that could affect sealing of the test bungs.
- Ensure that the test stoppers are placed tightly, squarely and in the pipe barrel, not the fittings.
- Ensure that all openings are properly sealed, including those to be buried underground, prior to testing and backfilling (e.g. gulley and lateral pipe connections).
- Although convenient, the air test is more sensitive than water tests and failure is not conclusive. The air test is very sensitive to temperature changes and must not be performed unless the pipe temperature is stable.
- Failures due to testing immediately after backfilling a pipe that has previously been heated in the sun are common. A 1°C temperature change in the air inside the pipe will result in a pressure change sufficient for the test to fail.

Water Test Method

1. Appropriate stoppers should be fitted, blocking the pipe ends and any junctions.
2. A standpipe or flexible pipe should be fitted at the top end of the pipeline, a maximum of 1.2 metres above the crown at the high end and 6 metres at the low end of the pipeline.
3. The pipe should be filled with water and allowed to stabilise for 2 hours, topping it up as required.
4. The loss of water from the pipeline should be determined by measuring the quantity of water added to the pipeline to maintain the level during the 30 minute test period.
5. The rate of water loss should not exceed 1 litre per hour per linear metre of drain per metre of nominal pipe diameter.

The maximum allowable loss of water during the 30 minute test is given in Table 3.5.3

Table 3.5.3 Maximum Allowable Water Losses During 30 Minute Water Test

DIAMETER (mm)	MAXIMUM LOSS (l/m)
100	0.05
150	0.075
225	0.1125
300	0.15
375	0.1875
400	0.2
450	0.225
500	0.25
600	0.3
750	0.375
900	0.45
1050	0.525

Mandrel Testing

Mandrel testing is frequently specified to prove the quality of installation on smaller diameter pipes. The size of mandrel is typically specified as 10mm less than the minimum diameter of the pipe. Flexible pipes deflect to a degree due to installation and backfilling. The Highways Agency typically limits post construction deflection to 5%, therefore the maximum recommended size of mandrel will be 10mm smaller than 95% of the original inside diameter of the pipe to be tested.

CCTV Surveying

The blue inner wall of Ridgidrain, Ridgisewer and the coloured wall of Polysewer pipe systems facilitates CCTV surveying. This is because it is difficult to adequately light pipes with a black inner wall.

Maintenance

Structured walled thermoplastic pipe systems do not require routine maintenance. However, where the design flows through a pipe system is insufficient, long term deposition of silt and/or solids may occur. Maintenance is therefore normally limited to de-silting/solids removal.

Access

Access to the system should be provided by conventional means such as manholes, catchpits, inspection chambers or rodding points.

Rodding

Structured walled pipe systems may be rodded using standard flexible drain rods.

Water Jetting

It is recommended that water jetting operations follows the procedures laid out within Sewer Jetting Code of Practice, 2nd Edition (WRc, 2005). Observing all other relevant pieces of legislation and recognised codes of practice.

Introduction

There are two principle types of jetting unit

- Low pressure, high volume

  Low pressure, high volume units are typically lorry mounted, with a large water carrying capacity and a facility for vacuum extraction of debris.

- High pressure, low volume

  High pressure, low volume units are typically small trailer mounted units with a minimal water carrying capacity and generally do not have a facility for removing material from the system being cleaned.

Polypipe Civils always recommends the use of low pressure, high volume units when jetting plastic pipes.

The appropriate unit type is largely dependant on the pipe diameter and whether jetting is being used for blockage removal or cleaning. Cleaning generally requires higher flow rates to ensure finer deposits are re-entrained into the sewage or surface water flow and transported downstream. Larger and heavier material is kept in motion through the power of the jets, progressively rolling the deposits down the pipeline. Typically, for the same power output, an increase in flow rate can be more effective than increasing the pressure when removing debris.

Maximum Recommended Pressures

The ability of a drain or sewer to withstand jetting without damage depends on its structural condition.
The maximum recommended pressure for plastic sewers and drains, in good structural condition, is 180 bar (2600 psi).

However, material does not readily bond to polymer pipes due to their smooth non-porous bore and low surface energy. Research has shown that debris can be easily removed from plastic pipes at pressures below 1500 psi.

It should be noted that where details of the sewer material or structural condition is unavailable and there is no evidence to suggest the pipe is in a good condition, it is recommended that a maximum pump pressure of 130 bar (1900 psi) is used [Except in areas where brick masonry or pitch fibre sewers may be present a maximum 100 bar (1500 psi) is recommended].

Recommended maximum jetting pressures may be as low as 80 bar (1200 psi) for pipes in extremely poor structural condition.

Summary of Basic System Performance Tests

The table below is intended to give an indication of the extensive performance tests carried out on structured walled thermoplastic pipes. Reference should be made to the relevant system specification for performance requirement details.

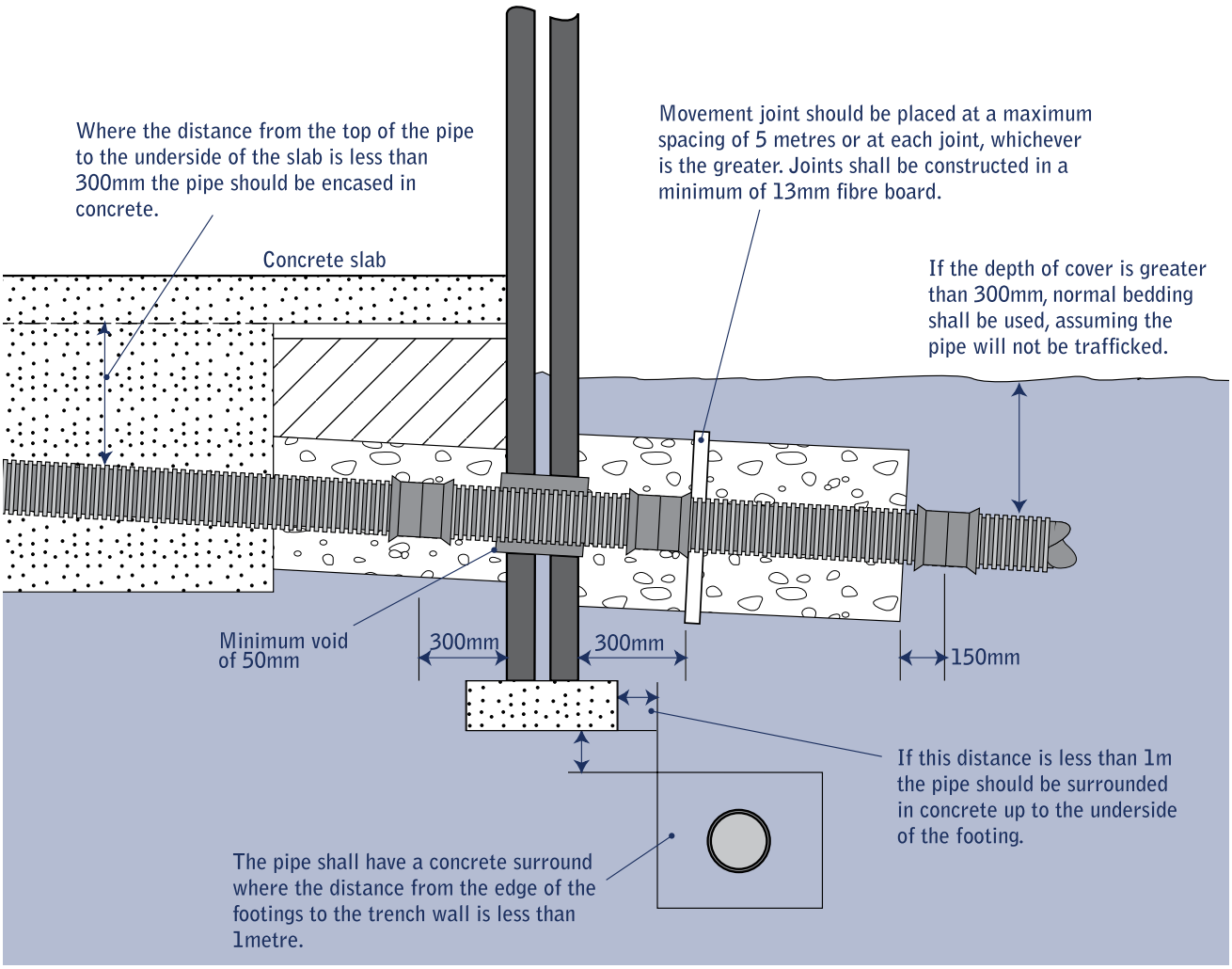
		PRODUCT		
PROPERTY	STANDARD	RIDGIDRAIN	RIDGISEWER	POLYSEWER
Ring flexibility	BS EN 1446		x	x
Ring stiffness	BS EN ISO 9969	x	x	x
Creep Ratio	BS EN ISO 9967	x	x	x
Impact resistance	BS EN 1411	x	x	x
Leaktightness of joints	BS EN ISO 1277	x	x	x
Strength or flexibility of fabricated fittings	BS EN ISO 12256	x	x	
Water tightness of fabricated fittings	BS EN 1053	x	x	x
Long term strength and heat resistance (Box loading)	BS EN 1437			x
Heat test (Injection moulded fittings)	BS EN 763	x	x	x
Resistance to water jetting	*Specification dependant	x	x	x
Longitudinal bending	** Specification dependant	x	x	x
Rodding resistance / internal puncture	# Specification dependant	x	x	X

* Ridgidrain — WRc Jetting Test Method (High volume low pressure)
Ridgisewer/Polysewer — WIS 4-35-01, Appendix C

**Ridgidrain — MCDHW, Volume 1, Clause 518.11
Ridgisewer/Polysewer — WIS 4-35-01, Appendix D

Although the same procedure is used in both system specifications, a different term is used.

What special requirements are needed near structures?


Where the distance from the top of the pipe to the underside of the slab is less than 300mm the pipe should be encased in concrete.
Concrete slab
Movement joint should be placed at a maximum spacing of 5 metres or at each joint, whichever is the greater. Joints shall be constructed in a minimum of 13mm fibre board.
If the depth of cover is greater than 300mm, normal bedding shall be used, assuming the pipe will not be trafficked.
Minimum void of 50mm
300mm
300mm
150mm
If this distance is less than 1m the pipe should be surrounded in concrete up to the underside of the footing.
The pipe shall have a concrete surround where the distance from the edge of the footings to the trench wall is less than 1metre.

Q. What is the crushing strength of Polypipe Civils pipes?

A. Unlike concrete or clay pipes, polymeric pipes do not have a specific crushing strength but are typically characterised by ring stiffness. Thermoplastic pipes deform under loading and rely on the pipe bed and surround material, in addition to the existing ground, to restrain any deformation. [Therefore a structural check, taking into account site conditions, may be required to ensure adequate pipe performance (Refer to Section 3.2 General - structural design)].

Q.How well does Polypipe Civils pipe systems cope with differential settlement?

A. Polypipe Civils thermoplastic pipes weigh less than 6% of the equivalent size of concrete pipe, resulting in a lower imposed pressure on the formation soils.

Thermoplastic structured walled pipes are generally better able to cope with differential settlement than rigid pipe systems, such as clay or concrete. Differential settlement of more traditional materials leads to stress concentrations in the pipe wall and premature failure. Thermoplastic pipe systems will merely deform further until the pipe/soil system regains equilibrium.

Additional joints may be easily and quickly introduced in thermoplastic pipe runs, increasing the system flexibility.

FAQ Section 3.8

Q. Do I need to install rocker pipes when forming chamber connections?

A. Although thermoplastic structured walled pipe systems are able to accommodate a degree of differential settlement, we recommend that the provisions outlined in a relevant code of practice be followed.

Sewers proposed for adoption under Section 104 of the Water Industries Act, 1991.

Sewers for Adoption (6th Edition) states a flexible joint should be provided as close as possible to the outside face of any structure into which a pipe is built. In addition, a rocker pipe be provided; to allow for differential settlement that may occur between the structure and pipeline.

The length of rocker pipe required is generally in accordance with the following table;

NOMINAL DIAMETER (mm)	EFFECTIVE LENGTH (m)
150 to 600	0.60
675 to 750	1.00
over 750	1.25

Table 1 Extracted from CESWI 6th Edition.

Stub and rocker pipes may be formed in the Ridgisewer system by simply cutting pipe sections on site to create the lengths required. Specific rocker and stub pipes are available for the nominal 750 & 900mm pipe diameters only.

Non-Adoptable sewers

In the absence of a detailed specification, we recommend that the provisions outlined in a relevant code of practice be followed.

In this regard we would draw your attention to BS 5955: Part 6: 1980; "Plastics Pipework (thermoplastics materials). Part 6, Code of practice for the installation of plasticized PVC pipework for gravity drains and sewers."

(Clause 7.3, reads as follows:)

"The provision of at least one flexible joint is recommended within 300 mm of the external face of the wall of any building and at each entry or exit point of all manholes and inspection chambers. Where abnormal settlement is expected, it is desirable to incorporate two flexible joints to form a 'rocker' length of pipe".

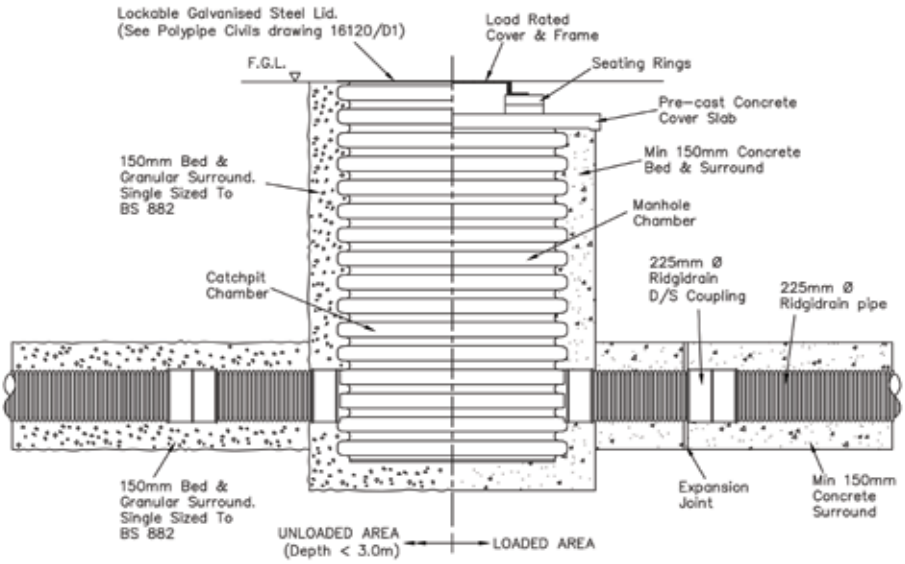
Q. Do Polypipe Civils offer catchpits and chambers?

A. Polypipe Civils Limited has an extensive fabrications department that can produce chambers using either its Ridgidrain or Ridgisewer pipe system. Catchpits and chambers are specifically fabricated to client specifications, offering base, channel, and coupling options to enable the construction of a complete plastic drainage system.

Plastic chambers have been used for many years for the construction of manhole chambers on non-adoptable sewers, however, it should be noted that Sewers For Adoption presently specifies that manholes to be of brickwork or pre-cast concrete construction.

Q. How are pre-fabricated chambers installed?

A. The burial depth and expected imposed loading dictate the recommended form of installation. Please refer to the figure below.



In unloaded situations, where the depth to invert is limited to 3.0m, a granular bed and surround may be used. In all other situations a concrete bed and surround is recommend.

Q. How do I form a connection with an existing concrete manhole?

A. It is normal practice when making connections to existing manholes for the soffit of the new pipe to be at the same level as the soffit of the outgoing pipe. When making connections to existing manholes the following procedure should be carried out:

- Excavate down side of manhole to level of base.
- At location of proposed connection, drill hole through manhole wall.
- Break out existing benching.
- The length of rocker pipe required is generally in accordance with the following table

Table 1 -Extracted from CESWI 6th Edition.

NOMINAL DIAMETER (mm)	EFFECTIVE LENGTH (m)
150 to 600	0.60
675 to 750	1.00
over 750	1.25

- Position stub and rocker pipes.
- Concrete in to position.
- Proceed to lay full length pipes away from manhole.

FAQ Section 3.8

Q. How do I repair a section of damaged pipe?

A.

The following procedure may be used to repair damage to an installed section of pipe.

- Excavate as required and remove the damaged section of pipe, ensuring all cuts are square and clean.
- Remove sufficient backfill, and bed and surround material, to enable the insertion of slip couplings completely over the ends of the undamaged pipe. Lubricate the inside of the couplings prior to installation.
- Fit sealing rings between the first and second pipe corrugations at each end of the undamaged pipe and lubricate.
- Cut a length of new pipe to replace the removed damaged section and fit sealing rings between the first and second corrugations at each end of pipe and lubricate.
- Insert the new pipe and centre the slip couplings over each joint.
- Form new bed and surround.
- Reinstate backfill to trench.

Note: Flexible rubber couplings may be used in place of slip couplings for diameters up to 600mm. Flexible rubber couplings are required for repairs to pipes 750mm and larger.

Q. How do I retrofit a pipe junction?

A.

Where a new connection to an existing pipeline is required, and an appropriate junction was not incorporated as it was being laid, a junction may be inserted into the pipeline.

Junction types vary, depending on the pipe system and diameter. However, they may be divided into the following forms:

a) Both ends of the main branch are socketed.

b) One end of the main branch has a socket.

c) The main branch is plain ended.

Accordingly the following procedures differ slightly depending on which junction is used.

a) Double Socket Junctions

- On the ground surface cut two short lengths of pipe. At one end of both short lengths, fit sealing rings between the first and second pipe corrugations. Insert the two short lengths of pipe into the sockets of the main branch. Fit sealing rings between the first and second pipe corrugations at each end.
- At the proposed location of the junction cut out the appropriate length of existing pipe.
- Remove sufficient backfill, bed and surround material to enable the insertion of slip couplings (or flexible rubber couplings) over the ends of the existing pipe.
- Fit sealing rings between the first and second pipe corrugations at each end of the existing pipe.
- Install slip couplings over the ends of the existing Ridgisewer pipe.
- Insert junction and centre slip couplings over each joint.
- Form new bed and surround.
- Reinstate backfill to trench.

b) Spigot and socket junctions

- Measure the effective length of the junction (ie from inside face of collar to end of spigot).
- At the proposed location of the junction insertion, cut out the appropriate length of existing pipe.
- Remove sufficient backfill material and bed and surround material at one end of the existing pipe to enable the insertion of a flexible rubber coupling (or slip coupling).
- Remove sufficient backfill, bed and surround material at the other end of the existing pipe to enable the junction socket to be pushed home.
- On the end of the existing Ridgisewer pipe to receive the junction socket, fit a sealing ring between the first and second corrugation.
- Insert socket of junction over end of existing Ridgisewer pipe to which sealing ring has been fitted.
- Centre flexible rubber coupling over spigot end of junction and tighten coupling.
- Form new bed and surround.
- Reinstate backfill to trench.

c) Plain ended junctions

- Measure the effective length of the junction (ie from inside face).
- At the proposed location of the junction insertion cut out the appropriate length of existing pipe.
- Remove sufficient backfill, bed and surround material at both ends of the existing pipe to enable the insertion of flexible rubber couplings (or slip coupling).
- Insert junction.
- Centre flexible rubber coupling over spigot end of junction and tighten coupling.
- Form new bed and surround.
- Reinstate backfill to trench.

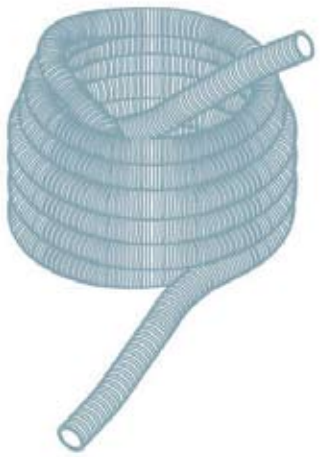
d) Ridgitite Saddle

Typically the diameters of such lateral connections would be either 110 & 160mm Ø. BS EN 1401-1 pipes or 150mm internal diameter clayware or thermoplastic structured wall pipes.

Therefore Polypipe Civils has developed the Ridgitite saddle to facilitate connection of these particular pipe diameters to existing pipelines. Available for nominal pipe diameters 300 to 600mm.
It should be noted, when connecting larger diameter pipes it is generally normal practice to construct a manhole.

FAQ Section 3.8

Q. Do Polypipe Civils offer a flexible gully connection…



A. 150mm Ø Ridgiflex is manufactured by Polypipe Civils specifically to provide a flexible connection pipe from the gully to the main carrier drainage.

Please note, if the drainage system is to be installed in accordance with the Manual Contract Documents for Highway Works, Clause 508.7 stipulates:

"Gully connection pipes shall be either flexible or rigid not exceeding 0.7m in length with flexible joints for a distance of 2m from the gully" "Junction pipes shall be manufactured of the same type and class of material as the remainder of the pipes in the run."

Therefore in strict accordance with the MCDHW, gully connections can only be formed with 150mm Ø Ridgidrain pipe. A dispensation would be required from the approving authority for the use of Ridgiflex.

Polypipe Civils Limited has successfully supplied Ridgiflex extensively within the market place, including road schemes, with no reported problems with respect to installation or maintenance.

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